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Preliminary Data Summary for the Wood Preserving Segment of the Timber Products Processing Point Source Category

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Summarizes most current information available regarding the discharge of wastewater by the wood preserving industry containing priority and nonpriority pollutants included on the 1987 Industrial Technology Division List of Analytes. Discusses the Agency's authority for conducting this study and the current regulatory status of the wood preserving industry. Presents estimates of industry raw waste pollutant loads based on information from the sampling episodes and control and treatment technologies that may be applicable to this industry.

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PRELIMINARY DATA SUMMARY
FOR THE
WOOD PRESERVING SEGMENT
OF THE
TIMBER PRODUCTS PROCESSING
POINT SOURCE CATEGORY

Engineering and Analysis Division
Office of Science and Technology
Office of Water
United States Environmental Protection Agency
Washington,D.C.

September 1991

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PREFACE

This is one of a series of Preliminary Data Summaries prepared by the Office of Science and Technology of the U.S. Environmental Protection Agency. The Summaries contain engineering, economic and environmental data that pertain to whether the industrial facilities in various industries discharge pollutants in their wastewaters and whether the EPA should pursue regulations to control such discharges. The summaries were prepared in order to allow EPA to respond to the mandate of section 304(m) of the Clean Water Act, which requires the Agency to develop plans to regulate industrial categories that contribute to pollution of the Nation's surface waters.

The Summaries vary in terms of the amount and nature of the data presented. This variation reflects several factors, including the overall size of the category (number of dischargers), the amount of sampling and analytical work performed by EPA in developing the Summary, the amount of relevant secondary data that exists for the various categories, whether the industry had been the subject of previous studies (by EPA or other parties), and whether or not the Agency was already committed to a regulation for the industry. With respect to the last factor, the pattern is for categories that are already the subject of regulatory activity (e.g., Pesticides, Pulp and Paper) to have relatively short Summaries. This is because the Summaries are intended primarily to assist EPA management in designating industry categories for rulemaking. Summaries for categories already subject to rulemaking were developed for comparison purposes and contain only the minimal amount of data needed to provide some perspective on the relative magnitude of the pollution problems created across the categories.

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EXECUTIVE SUMMARY

The Engineering and Analysis Division (EAD, formerly the Industrial Technology Division) of the U.S. Environmental Protection Agency (EPA) conducted a preliminary characterization study of the wood preserving industry in response to section 304(m) of the Water Quality Act of 1987. Section 304(m) requires the Agency to develop a plan that identifies categories of sources discharging toxic or nonconventional pollutants for which effluent limitations guidelines and/or standards have not been previously published. Section 304(m) also directs that a schedule for the annual review and revision of promulgated effluent guidelines be developed. The Agency has identified the wood preserving subcategories of the timber products processing point source category as candidates for study under the section 304(m) directive.

As part of the study, the Agency conducted engineering site visits at 14 wood preserving facilities and sampling episodes at five of the facilities visited. Wastewater and sludge samples were collected during the sampling episodes. Based on analysis of the samples collected, the range of annual pollutant loads for raw wastewaters on an industry-wide basis is approximately:

Volatile Organics	
Priority Organics	660-1,200 lbs/yr
Nonpriority Organics	5,400-16,000 lbs/yr
Semivolatile Organics	
Priority Organics	45,000-75,000 lbs/yr
Nonpriority Organics	103,000-169,000 lbs/yr
Dioxins/Furans[1]	21-21.5 lbs/yr
Pesticides/Herbicides	37-37.6 lbs/yr
Metals	163,000-164,000 lbs/yr

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[1] 2,3,7,8-TCDD was not detected in any samples. The pollutant loads presented are in terms of total mass, not 2,3,7,8-TCDD equivalents.

Semi-quantitative Metals	225,000-237,000 lbs/yr
Conventional Pollutants	
BOD	3,450,000-3,500,000 lbs/yr
Oil & Grease	229,000-232,000 lbs/yr
TSS	804,000-806,000 lbs/yr

The estimates presented above do not include pollutant loadings from facilities that treat only with inorganic preservatives. Facilities that treat with inorganic preservatives have not been allowed to discharge process wastewater directly to the surface waters of the United States since 1974. These facilities have not been allowed to discharge process wastewater to publicly-owned treatment works (POTWs) since 1982.

Most facilities that treat wood with organic preservatives practice some degree of reuse and recycle of process waters. For this reason, the pollutant loadings shown above for raw wastewater are higher than those actually discharged by the wood preserving industry.

Various control technologies, including both process changes and end-of-pipe treatment, are available to reduce the pollutant loads discharged from wood preserving facilities. Process changes include wastewater volume reduction, waste stream segregation, and drippage control. End-of-pipe treatments include oil/water separation, chemical flocculation, slow sand filtration, biological treatment, and evaporation.

This document summarizes the most current information available regarding the discharge of wastewater by the wood preserving industry containing priority and nonpriority pollutants included on the 1987 Industrial Technology Division List of Analytes. Section I discusses the Agency's authority for conducting this study and the current regulatory status of the wood preserving industry. The methodology used in conducting the study is described in Section II. A profile and description of the wood preserving industry are presented in Section III. A description of the facilities sampled along with the analytical results for each sampling episode is provided in Section IV.

Section V presents estimates of industry raw waste pollutant loads based on information from the sampling episodes, and Section VI discusses control and treatment technologies that may be applicable to this industry.

SECTION I
INTRODUCTION

A. BACKGROUND

Wood preserving facilities treat wood with chemical preservatives to prevent or delay deterioration or decay. The most common preservatives used are creosote, pentachlorophenol, and various formulations of waterborne, inorganic chemicals. Wood preserving processes consist of conditioning to remove moisture from the wood followed by the application of preservative. There are over 500 wood preserving facilities in the United States.

This document summarizes the most current information available regarding the generation and management of wastewater and solid wastes by the wood preserving industry. The objectives of this document are to 1) provide a summary of current information on wood preserving liquid and solid wastes, and 2) provide a technical basis for evaluating whether the industry should undergo further study.

B. PURPOSE AND AUTHORITY

The purpose of this study was to obtain a preliminary characterization of wastewaters and solid wastes generated by the wood preserving industry, and to develop an estimate of the pollutant loadings in wastewater from wood preserving operations.

The U.S. Environmental Protection Agency (EPA) is required by Section 301(d) of the Federal Water Pollution Control Act Amendments of 1972 and 1977 (the Clean Water Act), to review and revise, if necessary, effluent limitations and standards promulgated pursuant to Sections 301, 304, and 306. In conjunction with this review program, and as a result of a court settlement with several environmental groups, EPA has undertaken a major examination of toxic pollutants discharged by industrial sources.

To achieve these goals, the Engineering and Analysis Division (EAD) is responsible for (1) developing, proposing, and promulgating effluent limitations guidelines, based on best practicable control technology (BPT) and best available technology economically achievable (BAT), new source performance standards (NSPS), pretreatment standards for existing and new sources (PSES and PSNS), and for developing best management practices (BMPs) for industrial facilities; (2) ensuring the adequacy and validity of scientific, economic and technical data and findings used to support the effluent limitations and standards; (3) gathering, developing and analyzing data and background information basic to the annual review and periodic revision of the limitations and standards; and (4) developing technical information required for the judicial review of effluent limitations guidelines and standards.

Section 304(m), added by the Water Quality Act of 1987, established a new process for planning the development of effluent limitations guidelines and standards under the Clean Water Act (CWA). Section 304(m) directs EPA to publish biennial plans for the annual review and revision of promulgated effluent guidelines and standards. On January 2, 1990 (55 FR 80), the wood preserving subparts of the timber products processing point source category were identified as a segment of the industry for which additional information should be collected under the Section 304(m) directive (see 55 FR 97).

In addition to its responsibilities under the CWA, EPA is also charged by the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, with oversight of cradle-to-grave management of hazardous wastes. Section 3018(a) of RCRA, as amended by the 1984 Hazardous and Solid Waste Amendments (HSWA), directed EPA to submit a report to Congress concerning wastes discharged through sewer systems to publicly owned treatment works (POTWs) that are exempt from RCRA regulation as a result of the Domestic Sewage Exclusion of RCRA. The Domestic Sewage Exclusion (DSE), which was established by Congress in section 1004(27) of RCRA, provides that solid or dissolved material in domestic sewage is not solid waste as defined in RCRA. Therefore, such materials cannot be considered a hazardous waste for purposes of RCRA. The Domestic Sewage Exclusion applies to industrial wastewater discharged to municipal sewers that contain domestic sewage, even if the industrial wastewater would otherwise be considered hazardous.

Implicit in the Domestic Sewage Exclusion is the assumption that the pretreatment program mandated by the CWA can ensure adequate control of industrial discharges to sewers. This program, detailed under section 307(b) of the CWA and implemented in 40 CFR Part 403, requires EPA to establish pretreatment standards for pollutants discharged to POTWs by industrial facilities for those pollutants that interfere with, pass through, or otherwise are incompatible with the operation of POTWs.

Section 3018(b) of RCRA directs the Administrator to revise existing regulations and promulgate pretreatment standards for specific hazardous pollutants when necessary to ensure that hazardous wastes discharged to POTWs are controlled adequately. These standards are to be promulgated pursuant to RCRA, section 307 of the CWA, or any other appropriate authority possessed by EPA.

EPA's Office of Water submitted *The Report to Congress on the Discharge of Hazardous Wastes to Publicly Owned Treatment Works (EPA-530-SW-86-004)* to Congress on February 7, 1986. This report, referred to as the Domestic Sewage Study or DSS, examined the nature and sources of hazardous wastes discharged to POTWs, measured the effectiveness of EPA's program in dealing with such discharges, and recommended ways to improve the programs to achieve better control of hazardous wastes being discharged to POTWs.

The DSS concluded that the Domestic Sewage Exclusion should be retained at the present time and recommended ways to improve various EPA programs under the CWA to obtain better control of hazardous wastes being discharged to POTWs. In addition, the DSS recommended research efforts to fill information gaps, and indicated that other statutes (such as RCRA and the Clean Air Act) should be considered, along with the CWA, when establishing controls for either hazardous waste dischargers or receiving POTWs or both.

One of the recommendations of the DSS was that EPA review and amend categorical pretreatment standards to achieve better control of the pollutants in hazardous wastes. The DSS recommended that the Agency modify existing standards to improve control of organic priority pollutants, organic non-priority pollutants, and conventional pollutants, and that EPA promulgate categorical pretreatment standards for industrial categories not included in the Natural Resources Defense Council consent decree (NRDC v. Train, 8 ERC 2120, D.C.C. June 8, 1976).

This preliminary characterization study of the wood preserving industry was conducted under the authority of Sections 301(d) and 304(m) of the CWA, which require periodic review and revision of limitations promulgated pursuant to Sections 301, 304, and 306 of the CWA.

C. REGULATORY STATUS UNDER THE CWA

This study constitutes the fourth wastewater study of the wood preserving industry subcategories of the timber products processing point source category. Effluent guidelines, new source performance standards, and pretreatment standards for new sources for the wood preserving segment were promulgated in April 1974, pretreatment standards for existing sources were promulgated in December 1976, and revisions to the regulations were published in January 1981. Limited information that has been gathered indicates that significant procedural and operational changes have occurred at wood preserving facilities since 1981. The current effluent guidelines and standards for the Boulton and steam subcategories are presented in Tables I-1 and I-2, respectively. The limitation for all levels of control for the Wood Preserving-Waterborne or Nonpressure subcategory is no discharge of process wastewater pollutants. The information presented in this preliminary data summary will be used by the Agency to evaluate whether the existing guidelines and standards for wood preserving should be studied further.

D. RELATED REGULATORY ACTIVITIES

On December 6, 1990 (55 FR 50450), EPA amended its hazardous waste listing regulations under the Resource Conservation and Recovery Act (RCRA) by listing as hazardous three categories of wastes from wood preserving operations that use chlorophenolic, creosote, and/or inorganic (arsenical and chromium) preservatives. The listed wastes are wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving processes generated at plants that use (1) chlorophenolic formulations, (2) creosote formulations or (3) inorganic preservatives containing arsenic and chromium (F032, F034, and F035, respectively). The new listings do not include K001, bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol.

The term "wastewaters" in these listings includes, but is not limited to, wastewater generated from steam conditioning the wood prior to applying the preservative, preservative formulation recovery and regeneration wastewater, and water used to wash excess preservative from the surface of preserved wood. Operations that involve the rinsing of drums, storage tanks, the process area, and equipment also generate wastewater that is included in the listings. Finally, water, including rainwater, that accumulates in door and retort sumps and rainwater falling on or in the immediate vicinity of the treating cylinder or work tank area is also included in the listings. Storage area rainwater is not included in the listing definition.

The term "process residuals" in the listings includes materials such as sawdust, wood chips, sand, dirt, and stones that are attached to the wood when it enters the treating cylinder or tank and are washed off the wood during the treating process. These materials will form a residue in the treating cylinder or tank, and may settle out of the preservative solution elsewhere in the process or be removed during filtration of the preservative prior to its reuse. Tar and emulsified or polymerized oils may also settle out in the treating cylinder or tank during wood preserving operations using creosote or pentachlorophenol. These wastes are also considered process residuals.

The term "drippage" refers to excess preservative that exudes from the wood following treatment. The December 6, 1990 listing does not apply to precipitation runoff from treated wood in the storage yard or runoff from the storage yard itself. The listing preamble states that drippage must cease on the process area drip pad before the treated wood can be moved to the storage yard.

As discussed in Part B of this section, wastewaters discharged to sewers and eventually to POTWs by wood preserving facilities are exempt from RCRA regulations under the Domestic Sewage Exclusion of RCRA. Similarly, treated effluent from wastewater treatment at wood preserving facilities discharged under a NPDES permit is also exempt from RCRA regulations (40 CFR Part 261.4). However, when the hazardous waste listings for the wood preserving industry discussed above become effective, these wastewaters will be subject to RCRA requirements when they are managed on site and prior to discharge. Once a listed wastewater is discharged from a wood preserving facility, the RCRA requirements no longer apply. The wastewater is subject to Clean Water Act pretreatment standards if it is indirectly discharged, and all NPDES permit provisions if it is directly discharged.

Table I-1

Summary of Effluent Guidelines and Standards for Wood Preserving-Boulton Subcategory

Level of Control	Limitations		
BPT	No discharge of process wastewater pollutants		
BAT	No discharge of process wastewater pollutants		
NSPS	No discharge of process wastewater pollutants		
PSNS	No discharge of process wastewater pollutants		
PSES		Maximum for any 1 day	
		mg/l	gm/m^3 production
	Oil & Grease	100	20.5
	Copper	5	0.62
	Chromium	4	0.41
	Arsenic	4	0.41

Table I-2

Summary of Effluent Guidelines and Standards for Wood Preserving-Steam Subcategory

Level of Control	Limitations		
BPT		kg/1000 m^3 of product	
		(A)	(B)
	COD	1,100	550
	Phenols	2.18	0.65
	Oil & Grease	24.0	12.0
	pH	6.0-9.0	6.0-9.0
BAT	Reserved		
NSPS	No discharge of process wastewater pollutants		
PSNS	No discharge of process wastewater pollutants		
PSES		Maximum for any 1 day	
		mg/l	gm/m^3 production
	Oil & Grease	100	20.5
	Copper	5	0.62
	Chromium	4	0.41
	Arsenic	4	0.41

(A) - Maximum for any one day.

(B) - Average of daily values for 30 consecutive days.

SECTION II

SUMMARY OF METHODOLOGY

In this study, EPA directed its efforts toward characterizing current practices and processes in the wood preserving industry. The efforts included a review of published information on the industry and a sampling and analytical program, as described below.

A. REVIEW AND ASSESSMENT

A review of available information on the wood preserving was conducted. The documents reviewed included:

- Wood preserving trade association documents;
- EPA documents including the *Development Document for Effluent Limitations Guidelines and Standards for the Timber Products Processing Point Source Category, January 1981* and the *Background Document Supporting the Proposed Listing of Wastes for Wood Preservation and Surface Protection Processes, December, 1988*; and,
- Lists of wood preserving plants and statistics from various sources.

Information gathered during this review included:

- Descriptions of standard industry processes and practices, including waste generation and waste treatment and handling;
- Industry statistics on wastewater generation rates, production levels, preservatives used, and trends in the industry;
- Waste characterization data, including water use and wastewater characterization data; and
- Information on control and treatment technologies.

It is important to note that the information available does not represent a survey of 100 percent of the wood preserving industry. However, the available information does indicate some trends in the industry. In the last decade, wood preserving facilities have been switching from the use of traditional organic preservatives, such as creosote and pentachlorophenol, to the use of waterborne preservatives. In 1973, seventeen percent of the industry production was wood treated with waterborne preservatives, as reported by the American Wood Preservers Association (AWPA). In 1986, 59 percent of the industry production was wood treated with waterborne preservatives (Reference 1). Another trend in the industry was the increase in extensive internal recovery, reclamation, and reuse and recycling of wood preserving solutions to reduce the volume of wastewaters and sludges generated.

To obtain a current assessment of industry practices and waste characteristics, EPA conducted and engineering site visit and waste sampling program in 1988 and 1989. During this program, engineering site visits were conducted at thirteen wood preserving facilities and sampling episodes were conducted at five wood preserving facilities as discussed below.

B. SAMPLING AND ANALYTICAL PROGRAM

Based on the industry information reviewed, a site selection/plant sampling program was initiated in an effort to obtain a current characterization of the wood preserving industry and the types of liquid and solid wastes generated by the wood preserving industry. Selection of facilities for engineering site visits focused on pressure treating plants using creosote or pentachlorophenol preservatives. Facilities that use waterborne preservatives have been subject to a "no discharge" standard since 1974, and wastewater generated at these facilities is typically reused in preparing preservative formulations. Since no facilities were identified during this study that use waterborne preservatives and treat or discharge wastewater, no facilities that use waterborne preservatives were included in the sampling program.

Facilities selected for site visits were intended to be characteristic of the organic pressure treating subcategories represented in terms of processing steps and level of production. Facilities were also selected to represent effective, state-of-the-art handling and disposal of waste effluents and sludges. Considerations in selecting facilities for sampling were the processes employed, accessibility of sampling points, and the rate of wastewater flow through the facility's treatment system. The rate of wastewater flow was a consideration because some facilities batch treat wastewater and discharge it on a schedule that is too infrequent or unpredictable to allow for reasonable scheduling of sample collection.

Using the criteria listed above, thirteen facilities were selected for site visits and five of the thirteen visited were selected for sampling. A description of the five facilities sampled is presented in Section IV. Treatment system influent and effluent samples were collected if representative samples could be obtained. Samples were also collected at intermediate points in the wastewater treatment system where appropriate. Trip blanks, sample blanks, and duplicate samples were collected and analyzed for quality assurance/quality control purposes.

The samples obtained were analyzed for constituents on the 1987 Industrial Technology Division List of Analytes. This list contains conventional pollutants, excluding fecal coliform, and EPA's Priority Pollutants, excluding asbestos, as well as 285 other inorganic nonconventional pollutants or pollutant characteristics. The pollutants on the List of Analytes were derived from other EPA lists, including the Superfund Hazardous Substance List, the RCRA Appendix VIII and Appendix IX, and the list of analytes proposed to be added to RCRA Appendix VII by the Michigan Petition (49 FR 49793).

A summary of the analytical program, listing the types of waste samples and QA/QC samples collected and the types of analyses performed on these samples, is provided in Table II-1. A full list of analytes is presented in Table II-2.

Table II-1

Summary of Analytical Program

Pollutant Group	Trip Blanks	Sampler Blanks	Wastewater Samples	Duplicate Samples	Sludge Samples	Sludge TCLP Extract
Volatile Organic Pollutants	X		X	X	X	
Semivolatile Organic Pollutants		X	X	X	X	X
Pesticides and Herbicides		X	X	X	X	X
Dioxins and Furans			X	X	X	
Metals			X	X	X	X
Classical Pollutants[1,2]			X	X	X	

[1] Classical pollutants for liquid samples: biochemical oxygen demand, total suspended solids, total dissolved solids, fluoride, chloride, chemical oxygen demand, nitrate-nitrite, total phosphorus, sulfate, total organic carbon, total Kjeldahl nitrogen, ammonia, total cyanide, total sulfide, oil and grease, flash point, corrosivity.

[2] Classical pollutants for sludge samples: chemical oxygen demand, total phosphorus, nitrate-nitrite, ammonia, total Kjeldahl nitrogen, total cyanide, total sulfide, oil and grease, flash point, corrosivity, total solids, total volatile solids.

Table II-2

1987 ITD List of Analytes

Volatile Organic Pollutants

1,1,1,2-tetrachloroethane
1,1,1-trichloroethane
1,1,2,2-tetrachloroethane
1,1,2-trichloroethane
1,1-dichloroethane
1,1-dichloroethene
1,2,3-trichloropropane
1,2-dibromoethane
1,2-dichloroethane
1,2-dichloropropane
1,3-dichloropropane
1,3-dichloropropylene
1,3-dichloro-2-propanol
1,4-dioxane
1-bromo-2-chlorobenzene
1-bromo-3-chlorobenzene
2-butenal
2-chloroethyl vinyl ether
2-hexanone
2-picoline
3-chloropropene
4-methyl-2-pentanone
acetone
acrolein
acrylonitrile
allyl alcohol
benzene
bromoform
bromodichloromethane
bromomethane
carbon disulfide
carbon tetrachloride
chlorobenzene
chloroethane
chloroform
chloromethane
chloroprene
cis-1,3-dichloropropene
dibromochloromethane
dibromochloropropane
dibromomethane
dichlorofluoromethane
diethyl ether
dimethyl sulfone
ethyl benzene
ethyl cyanide
ethyl methacrylate
isobutyl alcohol
methacrylonitrile
methyl ethyl ketone
methyl iodide
methyl methacrylate
methylene chloride
N,N-dimethylformamide
tetrachloroethene
toluene
trans-1,2-dichloroethene
trans-1,3-dichloropropene
trans-1,4-dichloro-2-butene
trichloroethene
trichlorofluoromethane
vinyl acetate
vinyl chloride

Semivolatile Organic Pollutants

1,2,3-trichlorobenzene
1,2,3-trimethoxybenzene
1,2,4,5-tetrachlorobenzene
1,2,4-trichlorobenzene
1,2-dichlorobenzene
1,2-diphenylhydrazine
1,3,5-trithiane
1,3-dichlorobenzene
1,4-dichlorobenzene
1,4-dinitrobenzene

Table II-2

(Continued)

Semivolatile Organic Pollutants (Cont.)

1,4-naphthoquinone
1,5-naphthalenediamine
1-chloro-3-nitrobenzene
1-methylfluorene
1-methylphenanthrene
1-naphthylamine
2,3-dichloroaniline
2,3-dichloronitrobenzene
2,4,5-trichlorophenol
2,4,5-trimethylaniline
2,4-dimethylphenol
2,4-dinitrophenol
2,4-dinitrotoluene
2,6-dichlorophenol
2,6-dinitrotoluene
2,6-di-tert-butyl-p-benzoquinone
2-chloronaphthalene
2-chlorophenol
2-isopropylnaphthalene
2-methylbenzothiazole
2-methylnaphthalene
2-nitroaniline
2-naphthylamine
2-nitrophenol
2-phenylnaphthalene
2-(methylthio)benzothiazole
3,3-dichlorobenzidine
3,3-dimethoxybenzidine
3,6-dimethylphenanthrene
3-methylcholanthrene
3-nitroaniline
4,4'-methylene bis(2-chloroaniline)
4,5-methylene phenanthrene
4-aminobiphenyl
4-bromophenyl phenyl ether
4-chlorophenyl phenyl ether
4-chloro-2-nitroaniline
4-chloro-3-methylphenol
4-nitrobiphenyl
4-nitrophenol
5-chloro-o-toluidine
5-nitro-o-toluidine
7,12-dimethylbenz(a)anthracene
acenaphthene
acenaphthylene
acetophenone
alpha-terpineol
aniline
anthracene
aramite
benzanthrone
benzidine
benzoic acid
benzo(a)anthracene
benzyl alcohol
biphenyl
bis(2-chloroethoxy)methane
bis(chloroethyl)ether
bis(2-chloroisopropyl)ether
bis(2-ethylhexyl)phthalate
benzo(a)pyrene
benzo(b)fluoranthene
benzo(ghi)perylene
benzo(k)fluoranthene
benzyl alcohol
biphenyl
bis(2-chloroethoxy)methane
bis(chloroethyl)ether
bis(2-chloroisopropyl)ether
bis(2-ethylhexyl)phthalate
bis(chloromethyl)ether
bromoxynil
butyl benzyl phthalate
carbazole
chrysene
dibenzothiophene

Table II-2

(Continued)

Semivolatile Organic Pollutants (Cont.)

dibenzo(a,h)anthracene
dichloran
diethyl phthalate
dimethyl phthalate
dinitrocresol
diphenyl ether
diphenyl sulfide
diphenylamine
di-n-butyl phthalate
di-n-octyl phthalate
di-n-propylnitrosamine
erythritol anhydride
ethylene thiourea
ethylmethane sulfonate
fluoranthene
fluorene
hexachlorobenzene
hexachlorobutadiene
hexachlorocyclopentadiene
hexachloroethane
hexachloropropene
hexanoic acid
indeno(1,2,3-cd)pyrene
isophorone
isosafrole
longifolene
nitrobenzene
N,N-dimethylformamide
N-decane
N-docosane
N-dodecane
N-eicosane
N-hexacosane
N-hexadecane
N-nitrosodiethylamine
N-nitrosodimethylamine
N-nitrosodiphenylamine
N-nitrosodi-n-butylamine
N-nitrosomethylethylamine
N-nitrosomethylphenylamine
N-nitrosomorpholine
N-nitrosopiperidine
n-octacosane
n-octadecane
n-tetracosane
n-tetradecane
n-triacontane
o-anisidine
o-cresol
o-toluidine
pentachlorobenzene
pentachloroethane
pentachlorophenol
pentamethylbenzene
perylene
phenacetin
phenanthrene
phenol
phenothiazine
pronamide
pyrene
pyridine
p-chloroaniline
p-cresol
p-cymene
p-dimethylaminoazobenzene
p-nitroaniline
resorcinol
safrole
squalene
styrene
thianaphthene
thioacetamide
thiophenol

Table II-2

(Continued)

Semivolatile Organic Pollutants (Cont.)

captafolthioxanthone
triphenylene
tripropylene glycol methyl ether

Pesticides and Herbicides

2,4,5-T
2,4,5-TP
2,4-D
4,4'-DDD
4,4'-DDE
4,4'-DDT
aldrin
alpha-BHC
azinphos-ethyl
azinphos-methyl
beta-BHC
captafol
captan
carbophenothion
chlordane
chlorfenvinphos
chlorobenzilate
chlorpyrifos
coumaphos
crotoxyphos
cygon
delta-BHC
demeton
diallate
diazinon
dichlone
dichlorvos
dicrotophos
dieldrin
dinoseb
dioxathion
disulfoton
endosulfan I
endosulfan II
endosulfan sulfate
endrin
endrin aldehyde
ethylenebisdithiocarbamic acid, salts and esters
famphur
fensulfothion
fenthion
gamma-BHC
heptachlor
heptachlor epoxide
hexamethylphosphoramide
isodrin
kepone
leptophos
malathion
maneb
methoxychlor
methyl parathion
mevinphos
mirex
monocrotophos
nabam
naled
nitrofen
parathion ethyl
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
PCNB
phorate
phosmet

Table II-2

(Continued)

Pesticides and Herbicides (Cont.)

phosphamidon
sulfotepp
TEPP
terbufos
tetrachlorvinphos
thiram
toxaphene
trichlorofon
tricresylphosphate
trifluralin
trimethylphosphate
zineb
ziram

Dibenzo-p-Dioxins and Dibenzofurans

2,3,7,8-TCDD
dibenzofuran
heptachlorodibenzofurans
heptachlorodibenzo-p-dioxins
hexachlorodibenzofurans
hexachlorodibenzo-p-dioxins
octachlorodibenzofurans
octachlorodibenzo-p-dioxins
pentachlorodibenzofurans
pentachlorodibenzo-p-dioxins
tetrachlorodibenzofurans
tetrachlorodibenzo-p-dioxins

Elements

aluminum
antimony
arsenic
barium
beryllium
bismuth
boron
cadmium
calcium
cerium
chromium
cobalt
copper
dysprosium
erbium
europium
gadolinium
gallium
germanium
gold
hafnium
holnium
indium
iodine
iridium
iron
lanthanum
lead
lithium
lutetium
magnesium
manganese
mercury
molybdenum
neodymium
niobium
osmium
palladium
phosphorus
platinum
potassium
praseodymium

Table II-2

(Continued)

Elements (Cont.)

- rhenium
- rhodium
- ruthenium
- samarium
- scandium
- selenium
- silicon
- silver
- sodium
- strontium
- sulfur
- tantalum
- tellurium
- terbium
- thallium
- thorium
- thulium
- tin
- titanium
- tungsten
- uranium
- vanadium
- ytterbium
- yttrium
- zinc
- zirconium

Conventional Pollutants

- BOD_5
- oil and grease, total recoverable
- pH
- TSS

Classical Nonconventional Pollutants

- ammonia, as N
- chloride
- COD
- conductivity
- corrosivity
- flash point
- fluoride
- nitrate/nitrite
- nitrogen, Kjeldahl, total
- reactivity
- residue, filterable
- salinity (with calcium)
- salinity (with sodium)
- sulfate
- total cyanide
- TDS
- total organic carbon
- total phosphorus
- total solids
- total sulfide
- total volatile solids

SECTION III
INDUSTRY DESCRIPTION

A. SUMMARY

Wood preservatives are used to delay deterioration and decay of wood caused by wood-destroying organisms such as insects, fungi, and marine borers. The term "wood preservative" may also refer to fire retardants, which prevent wood from supporting its own combustion. There are approximately 587 wood preserving facilities in the United States. The industry produces over 500 million cubic feet of treated wood per year. Data from 1987 (Reference 1) show that 97.8 million cubic feet of wood were treated with creosote, 48.6 million cubic feet with pentachlorophenol, and 419 million cubic feet with waterborne preservatives. Approximate yearly production within each wood preserving subcategory of the timber products processing point source category in 1984 was 419 million cubic feet for the Wood Preserving-Waterborne or Nonpressure subcategory, 125 million cubic feet for the Wood Preserving-Steam subcategory, and 21.4 million cubic feet for the Wood Preserving-Boulton subcategory (Reference 2). The average volume of wastewater generated per volume of wood treated is approximately 0.52 gal/ft^3 for facilities in the steam subcategory and 1.26 gal/ft^3 for plants in the Boulton subcategory (Reference 3). Facilities using waterborne preservatives typically do not discharge any wastewater.

A description of the chemicals and processes used by the industry is presented below.

B. STANDARD PROCESSES AND PRACTICES

1. Types of Preservatives

The most common preservatives used in wood preserving are creosote, pentachlorophenol, and inorganic arsenical and/or chromate salts (inorganics).

Creosote generically refers to mixtures of relatively heavy residual oils obtained from the distillation of tar or crude petroleum. Typical constituents of creosote are listed in Table III-1. Although creosotes can be derived from a variety of tars, including wood, petroleum, and coal-based tars, only coal tar-based creosotes are generally accepted for use as wood preservatives. Creosote formulations are used mainly in treating railroad ties, fence posts, lumber and timbers, crossarms, poles, and marine and fresh-water piling.

Pentachlorophenol is one of a group of synthetic organic compounds, called chlorophenols, which are commercially manufactured by reacting chlorine with phenol. For wood preserving, pentachlorophenol is used in a wide variety of solvents including heavy petroleum and creosote oils, light petroleum solvents, and volatile solvents. Standard petroleum oils are most frequently used in preparing the treating formulations, which typically contain 5 percent total pentachlorophenol. Pentachlorophenol impurities have been found to include penta- to octachlorinated dioxins and furans. Pentachlorophenol formulations are used primarily to treat poles, crossarms, lumber, timbers, and fence posts.

Table III-1

Typical Composition of Creosote[2]

Major Components	Range of Concentrations in Creosote (%)
Acenaphthene	9-14.7
Anthracene	2-7
Benz(a)anthracene	0.16-0.26
Benzo(a)pyrene	0.04-0.06
Benzofluorenes	1.0-2.0
Biphenyl	0.8-1.6
Carbazole	1.2-2.0
Chrysene	2.6-3.0
Dibenz(a,h)anthracene	0.01-0.04
Dibenzofuran	4.0-7.5
Dimethylnaphthalenes	2.0-2.3
Fluoranthene	0.5-10
Fluorene	7.3-10
Methylanthracenes	3.9-4.0
Methylfluorenes	2.3-3.0
1-Methylnaphthalene	0.9-12
2-Methylnaphthalene	1.2-12
Methylphenanthrenes	3.0
Naphthalene	1.3-18
Phenanthrene	16-21
Pyrene	1.0-8.5

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[2] IARC Monographs, Volume 35, "Coal Tar and Derived Products."

Inorganic preservatives consist of arsenical and chromate salts and fluorides dissolved in water. The most commonly used inorganic preservatives include:

- Chromated Copper Arsenate (CCA);
- Ammoniacal Copper Arsenate (ACA);
- Acid Copper Chromate (ACC);
- Chromated Zinc Chloride (CZC); and
- Fluor-Chrome-Arsenate-Phenol (FCAP).

The most frequently used formulation is CCA, which is typically diluted in water to 1 to 2 percent total CCA concentration. Inorganic preservative mixtures are likely to undergo chemical changes when heated to high temperatures during treatment. Maximum acceptable temperatures range from 120°F to 150°F. Inorganics are used primarily for the treatment of lumber and timber for the building industry.

2. Conditioning

The wood preserving process consists of two basic steps: (1) conditioning the wood to reduce its natural moisture content and increase its permeability to preservatives, and (2) impregnating the wood with the preservative. Various combinations of conditioning and preservative application processes are used at wood preserving facilities depending on the type of wood treated and the end use of the wood. Conditioning methods include:

- Steam conditioning;
- Vapor drying;
- Boulton conditioning;

- Kiln drying; and
- Air drying.

Steam Conditioning. Conventional steam conditioning (open steaming) is a process in which wood is subjected to direct steam impingement at an elevated pressure in a closed vessel or retort, thus vaporizing the water content of the wood. Immediately following steaming, a vacuum is applied for one to three hours to pull the steam and vaporized wood water from the retort. Steam condensate that forms in the retort is removed through traps and is generally conducted to oil/water separators for removal of free oils. The steam condensate may be further treated prior to reuse or discharge off site.

A variation of conventional steam conditioning is closed steaming, in which steam is generated in situ by covering coils in the retort with water from a reservoir and heating the water by passing process steam through the coils. The water is returned to the reservoir after oil separation and is reused during the next steaming cycle. A small blowdown from the storage tank is necessary to remove excess water and control the level of wood sugars in the water. Because the steaming water may be reused, closed steaming generates less wastewater than open steaming.

Modified closed steaming is another variation of the steam conditioning process in which steam condensate is allowed to accumulate in the retort during the steaming operation until it covers the heating coils. Direct steaming is then discontinued and the remaining steam required for the cycle is generated within the retort by using the heating coils. At the end of the steaming cycle, the water in the cylinder is discharged after oil contaminants are removed.

Vapor Drying. Vapor drying consists of exposing wood in a closed vessel to vapors from an organic chemical. Selected derivatives of petroleum and coal tar, such as high-flash naphtha, or Stoddard solvent, are preferred; but numerous chemicals, including blends, are also employed as drying agents in this process. Vapors for drying are generated by boiling the chemical in an evaporator. The vapors are conducted to the retort containing the wood, where they condense on the wood, give up their latent heat of vaporization, and cause the water in the wood to vaporize. The water vapor thus produced, along with excess organic vapor, is conducted from the vessel to a condenser and then to a gravity-type separator. The water layer is discharged from the separator and the organic chemical is returned to the evaporator for reuse. At the end of the heating period, the flow of organic vapors to the vessel is stopped, and a vacuum is applied for 30 minutes to 2 hours to remove the excess vapor along with any additional water. Since the drying cylinder frequently serves as the pressure treatment cylinder, the wood can be treated immediately after conditioning.

Boulton Conditioning. Boulton conditioning consists of heating wood in a preservative formulation in a pressure treating cylinder under vacuum conditions. The preservative, which has a boiling point higher than the boiling point of water, serves as a heat transfer medium. After the temperature in the treating cylinder is raised to operating temperature, a vacuum is drawn and water vaporizes from the wood, passes through the preservative bath, and is collected in a condenser. The condensate then may go to an oil-water separator and any further treatment or recycling steps. Boultonizing is usually limited to wood that is to be treated with creosote or pentachlorophenol formulations through a pressure treatment process.

Kiln Drying. In kiln drying, lumber or poles are placed in dry kilns in which air is circulated. Drying temperatures and times vary with wood species and the type of product. Kiln drying may produce wastewater in the form of condensate, which drains from the kiln during the drying cycle. Wood treated with inorganic preservatives may be kiln dried after treatment to remove excess water.

Air Drying. Air drying consists of allowing wood to dry at ambient temperatures in storage yards for several months or longer.

3. Preservative Application

After conditioning, preservatives may be applied by either pressure or nonpressure processes. Pressure processes for applying wood preservatives employ a combination of air and hydrostatic pressure and vacuum. Pressure treatment is accomplished by submerging wood in a preservative solution within a sealed cylinder, or retort. Nonpressure processes are usually carried out in open tanks, at atmospheric pressure. Wood is immersed in the treating chemicals, which may be at ambient temperature or above. Each of the major preserving processes is discussed below.

Pressure Treatment Processes. There are two basic types of pressure treatment processes, distinguished by the particular sequence of application of vacuum and pressure. The first pressure method is referred to in the industry as the "empty cell" process. In the empty cell process, the retort is first pressurized to force the preservative into the wood. The pressure cycle is followed by a vacuum to remove excess preservative. The empty cell process is used to obtain relatively deep penetration with limited absorption of preservative, typically desired for products such as railway ties, poles, fence posts, and construction lumber. The second method, known as the "full cell" process, results in higher retention of preservative but limited penetration compared to the empty cell process. In the full cell process, a vacuum is drawn on the retort, and the preservative is added, breaking the vacuum. The preservative is then forced into the wood under pressure. The full cell process is particularly desirable for wood used in the marine environment. The difference between the empty cell and full cell processes can be viewed simply as whether the objective is to fill the wood cells (full cell) or just to coat them (empty cell) with preservative. There is no difference in the types of wastes generated by full cell and empty cell processes, although wood treated by the full cell process may drip more and has a greater tendency to bleed than wood treated by the empty cell process.

A vacuum-only preservative process is also used. This process is simpler to control than the pressure-vacuum processes but requires more complex equipment than is generally used for nonpressure processes. The vacuum-only process is performed by enclosing wood in an airtight container, pulling an initial vacuum, and adding preservative solution to atmospheric pressure. The preservative is driven into the wood by the pressure difference between the initial vacuum and the atmospheric pressure. A final vacuum may be applied to control preservative retention and recover excess solution. The vacuum-only method is commonly used to treat window sashes with pentachlorophenol.

Nonpressure Treatment Processes. A limited quantity of wood is treated by nonpressure processes. Nonpressure processes include brushing or spraying, dipping, soaking, and thermal processes. The length of treatment and the concentration of the preservative are important factors in nonpressure processes because the preservative is driven into the wood by diffusion.

In the brushing and spraying methods of preserving wood, the preservative is applied to the surface of the wood in a thick layer and is allowed to soak in. Creosote and pentachlorophenol preservatives are generally applied by these methods. Brushing and spraying are most effective when applied to end-grain surfaces because better penetration occurs in the direction of the grain. The preservative is usually mixed and stored in tanks or drums.

Dipping is generally used to treat structural forms of timber and consists of immersing wood in a bath of preservative for a few seconds or a few minutes. Like brushing and spraying, dipping is also used to apply creosote and pentachlorophenol preservatives, although it generally uses more preservative. Dipping has the advantage over brushing and spraying of more adequately treating the wood by further penetration due to the longer contact period between the wood and the preservative.

Soaking involves immersing wood in an unheated oil solution (commonly a pentachlorophenol formulation) for periods ranging from two days to one week. The wood must be well-conditioned, i.e., dry, to achieve maximum absorption of the preservative. The effectiveness of treatment by soaking depends on the type of wood and on the product being treated. It is also possible to soak wood in water-based solutions for several days or even weeks at ambient temperature. This process is also referred to as steeping.

The thermal process involves the immersion of conditioned wood in successive baths of hot and cool preservative. Each stage typically takes 8 to 48 hours, depending on the ambient temperature and the water content of the wood. The hot baths expand the outer layers of the timbers and evaporate moisture through the surface of the wood. The cold bath causes the air and vapor in the outer shell of the wood to contract, thereby forming a partial vacuum. Atmospheric pressure then forces the surrounding preservative into the wood. Creosote and pentachlorophenol formulations are generally used in the thermal process, however, inorganic formulations have been used.

C. SUBCATEGORIZATION

The wood preserving subcategories of the timber products processing point source category were established when effluent guidelines and standards were first promulgated for the industry in 1974. When revisions to the regulations were promulgated in 1982, the title of the subcategory originally called Wood Preserving was changed to Wood Preserving - Waterborne or Nonpressure to be more descriptive of the subcategory. The subcategories are:

- Wood Preserving - Waterborne or Nonpressure: This subcategory includes wastewater from all nonpressure wood preserving treatment processes and all pressure wood preserving processes employing waterborne inorganic salts;

- Wood Preserving - Steam: This subcategory includes wastewater from wood preserving processes that use direct steam impingement on wood as the predominant conditioning method, processes that use the vapor drying process as the predominant conditioning method, processes which use the same retort to treat with both salt and oil type preservatives, and steam conditioning processes which apply both salt type and oil type preservatives to the same stock; and

- Wood Preserving - Boulton: This subcategory includes wastewater from wood preserving operations which use the Boulton process as the predominant method of conditioning.

SECTION IV
WASTE CHARACTERIZATION

A. WASTEWATER GENERATION

Process wastewater is defined under 40 CFR Part 401 of Chapter N-Effluent Guidelines and Standards as any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product (40 CFR 401.11q). The existing effluent limitations guidelines and standards for the wood preserving industry regulate all process wastewaters and precipitation runoff from the immediate process area where the process equipment is located. The term "process wastewater" specifically excludes material storage yard runoff (either raw material or processed wood storage).

The major sources of wastewater in the wood preserving industry are internal wood water which is removed from the wood during the conditioning process and steam condensate which is generated during conditioning. The wood water and steam condensate become contaminated from contact with the wood constituents, oil and grease, and preservative. Other sources of wastewater include wastewater generated during preservative formulation recovery and regeneration, drippage and spills from the retort, precipitation runoff, and wastewater from other miscellaneous sources. Wastewater generation can vary from one facility to another and is based on the types of conditioning and preservative application processes performed by the facility, as well as the facility's housekeeping and waste management practices.

The sources of wood preserving wastewaters for each subcategory are further described below.

- Boulton Subcategory. In the Boulton process, the conditioning step takes place in a preservative bath in the retort while the retort is operated under vacuum. The wastewater produced by this conditioning method consists of the water driven out of the wood and some residual preservative. The volume of wastewater produced will vary according to wood type and preservative formulation.

- Steam Subcategory. In steam conditioning, the wood is subjected to direct, semi-direct or closed steaming in order to vaporize the water contained in the wood. The wastewater resulting from steam conditioning consists of the water driven out of the wood and, in some cases, contaminated steam condensate.

- Waterborne or Nonpressure Subcategory. Wood treated with inorganic arsenical and/or chromate salts is almost exclusively conditioned by air or kiln drying. Inorganic processes can be operated with no net generation of wastewater because, 1) the conditioning methods used produce little or no wastewater, and 2) any excess water can be used in making up the next batch of preservative chemicals. Furthermore, condensate from vacuum systems and precipitation that falls in the treatment area may be used as makeup water for inorganic preservative formulations. In the air drying, or seasoning process, the untreated wood is kept in a storage yard for long periods of time to reduce the moisture content by natural evaporation. This process does not produce contaminated wastewater. In kiln drying, the moisture content is removed by holding the raw or fresh wood in controlled temperature and humidity conditions. Kiln drying following inorganic preservative application may produce a small amount of condensate contaminated with the preservative that can be reused. Air or kiln drying may also be used to condition wood prior to treatment with organic preservatives.

In addition to the above identified sources of wastewater for each subcategory, there are other sources of wastewater generation at wood preserving facilities. Some of the water driven out of the wood will accumulate in organic wood preserving formulations. This water is then separated from the preservative formulation using an oil/water separator. In processes utilizing a pressure/vacuum retort, not all of the wastewater generated in the retort can be effectively condensed and collected. Contaminated steam or condensate may leak from the retort door gaskets or drip from the door as it is opened; preservative solution residuals may also spill out as the door is opened. Blowdown from wet air pollution control devices, drum rinsates, vehicle and equipment washdown wastewater, process area washdown wastewater, and pole washer wastewater are other possible sources of wastewater.

B. WASTEWATER CHARACTERIZATION

The purpose of this section is to describe the characteristics of wastewaters and sludges generated by wood preserving processes. The information and data presented were developed from samples and information collected during this study of the wood preserving industry.

The Agency conducted sampling episodes at four wood preserving facilities in 1988 and one in 1989. Three of the facilities use the Boulton process or a modification of the Boulton process to condition and treat most of their wood. One of the facilities uses air drying to condition their wood but also conditions and treats wood using the Boulton process. Two of the Boulton facilities also use a thermal process to condition and treat a small percentage of their stock. The other Boulton facility treats some wood using waterborne preservatives. One of the facilities sampled is in the steam subcategory. This facility uses modified closed steaming followed by pressure treatment. All five facilities use pentachlorophenol and/or creosote as preservatives. Two of the facilities are indirect dischargers and three do not discharge any wastewater.

All sampling and analysis efforts were conducted using appropriate quality assurance and quality control procedures as specified by Handbook for Sample Preservation of Water and Wastewater, U.S. EPA, EMSL, Cincinnati, OH, EPA-600/4-82-029, September 1982, and procedures as specified in each Agency-approved method. The pollutants analyzed for these samples are presented in Section II of this document.

Analytical data summaries for each facility are presented at the end of this section. Data are presented only for pollutants that were detected at least once in the sampled streams for each facility. A description of each facility and a schematic diagram of the wastewater treatment system at the facility are provided in the following sections. To maintain confidentiality, each facility has been assigned a letter code.

1. Wood Preserving Facility A (Boulton Subcategory)

This facility, located in the Pacific Northwest, treats utility poles, posts, and pilings. The facility is capable of treating approximately 600,000 cubic feet of wood per year. The stock treated by the facility is approximately 50 percent Douglas fir and 50 percent western cedar.

Facility A treats wood with pentachlorophenol dissolved in a carrier solvent that is similar to No. 2 diesel oil. Ninety-five percent of the wood treated by the facility is treated in a single retort eight feet in diameter and 120 feet in length operated under pressure. The process used is the Lowry-Boulton method in which conditioning occurs under vacuum conditions, then the vacuum is released and the retort is allowed to stand at atmospheric pressure. The preservative solution is then added and the retort is pressurized to drive the preservative into the wood.

A small number of utility poles are treated in an open tank (known as a butt tank) by a thermal process. The poles are placed in the tank of preservative solution and conditioned by heating the preservative to 200°F. After conditioning, the hot preservative is pumped out and replaced with a cold preservative solution that is taken up by the conditioned wood.

The facility also performs ancillary operations including cutting and debarking poles and storing untreated and treated poles. The facility is capable of treating wood with creosote in addition to pentachlorophenol, however, creosote has not been used at the facility since 1982. Some creosote remained in tanks on-site at the time of the sampling episode.

Sources of wastewater at the facility are tree sap and moisture removed from the wood during conditioning, precipitation captured in the retort area, in the tankage areas and in open separating tanks, and equipment washdown water. The wastewater collection system consists of sumps for collection of spillage, storm water, and equipment washdown water, and tanks for storage of storm water and sap water condensate. The wastewater treatment system consists of two oil/water separators. The effluent is discharged to the municipal sewer. A schematic diagram of the process and wastewater treatment system is shown in Figure IV-1.

Wastewater consisting of the sap and moisture removed from the wood is generated during the conditioning process. This portion of the wastewater stream is drawn off under vacuum, condensed, and pumped to the primary oil/water separator. Drippage, storm water, and equipment washdown water collected in the various sumps are also pumped to the primary oil/water separator. Periodically, the water layer from the primary oil/water separator is drained into the secondary separator, a four-stage API type oil/water separator. Residual water from the oil/preservative layer in the second separator is evaporated in an evaporator tank. The oil/preservative mixture is returned to work tanks for reuse. Wastewater is discharged from the second separator to a holding pit. The pit discharges into the municipal sewer.

Most of the water treated and discharged to the municipal sewer system is storm water. The facility does not measure the volume of storm water captured and discharged to the sewer. Approximately 900 to 1200 gallons of sap water are generated per charge of wood to the pressure retort. The facility treats approximately 240 charges of wood per year. Plant personnel estimate that the wastewater treatment system discharges an average of 1,000 to 3,000 gallons of treated wastewater per week to the municipal sewer system.

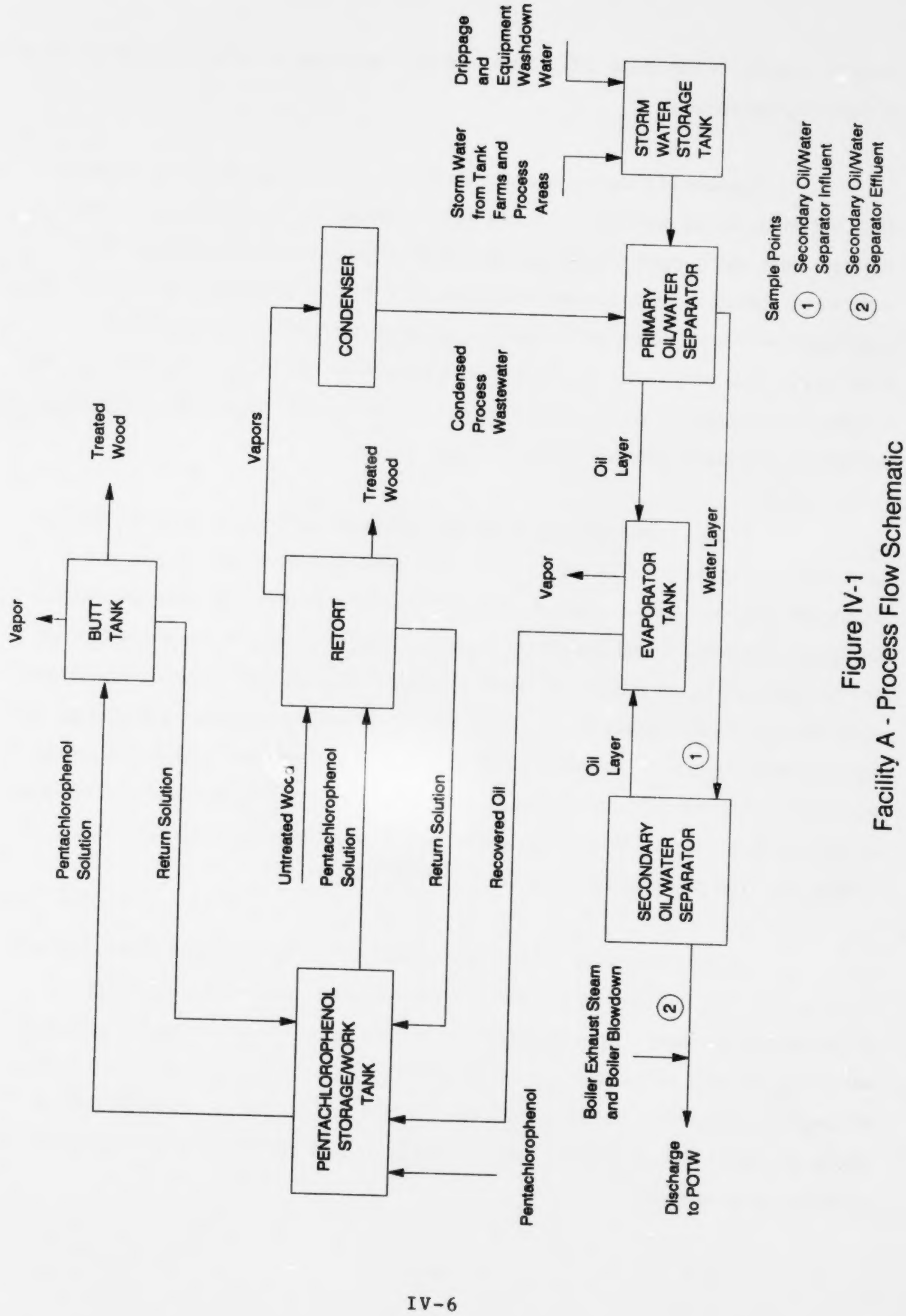
Vapor
BUTT TANK
Treated Wood
Pentachlorophenol Solution
Return Solution
RETORT
Treated Wood
Vapors
CONDENSER
Untreated Wood
Pentachlorophenol Solution
Return Solution
PENTACHLOROPHENOL STORAGE/WORK TANK
Pentachlorophenol
Recovered Oil
Condensed Process Wastewater
Storm Water from Tank Farms and Process Areas
Drippage and Equipment Washdown Water
STORM WATER STORAGE TANK
PRIMARY OIL/WATER SEPARATOR
Oil Layer
Water Layer
Vapor
EVAPORATOR TANK
Oil Layer
①
SECONDARY OIL/WATER SEPARATOR
②
Boiler Exhaust Steam and Boiler Blowdown
Discharge to POTW
Sample Points
① Secondary Oil/Water Separator Influent
② Secondary Oil/Water Separator Effluent

Figure IV-1
Facility A - Process Flow Schematic

The facility has a steam generating system consisting of a wood-fired boiler, vapor condensers, and a cooling tower. The steam generated is used to heat the preservative for the Lowry-Boulton and thermal treatment processes. Cooling water for the vapor condensers is cycled to the cooling tower and then reused. Similarly, vacuum seal water is a part of the same closed system and is recycled to the cooling tower and back. The thermal treatment process does not generate any wastewater as the tank is open and the sap water and collected storm water evaporate to the atmosphere. Boiler exhaust steam and boiler blowdown water are discharged to the holding pit with the wastewater from the second oil/water separator and then discharged to the municipal sewer.

Two samples of the influent to the secondary oil/water separator and two samples of the effluent from the secondary oil/water separator were collected at this facility for a total of four samples. Since the facility treats wastewater on a batch basis, all samples were collected as grab samples. The influent samples were grab samples collected from the inlet pipe to the separator. The effluent samples were also grab samples collected from the discharge pit after the separator. Samples were collected on two different days. On each day, the influent and the effluent sample were collected at approximately the same time. Sample collection locations are shown on Figure IV-1. A summary of the analytical results for the sampling episode is presented in Table IV-1 at the end of this section.

The final effluent from Facility A meets the existing discharge limits for oil and grease, copper, chromium, and arsenic. There was a decrease in the concentration of each of these pollutants in the effluent samples compared to the influent samples. However, the concentration of pentachlorophenol was higher in the effluent samples than in the influent samples. The influent concentrations of pentachlorophenol were 4,751 ug/l and 4,124 ug/l on Day 1 and Day 2 of sampling, respectively. The effluent concentrations of pentachlorophenol were 7,237 ug/l and 5,053 ug/l on Day 1 and Day 2 of sampling, respectively.

Influent sample concentrations of dioxins/furans were generally higher than their respective concentrations in the effluent samples. There was no consistent trend in the concentrations of pesticides/herbicides between the influent and the effluent samples; some concentrations increased and others decreased. Metal concentrations generally increased in the effluent samples compared to the influent samples.

2. Wood Preserving Facility B (Boulton Subcategory)

This facility, located in the Pacific Northwest, treats utility and telephone poles with pentachlorophenol and creosote. The facility produces approximately 100,000 cubic feet of treated Douglas fir and western red cedar per month. Approximately ninety percent of the facility's stock is treated with a solution of five percent pentachlorophenol in a medium aromatic oil that is similar to No. 2 diesel oil. The remaining stock is treated with a solution of creosote and coal tar.

The facility conditions wood by air drying. Alternatively, wood may be conditioned using the Boulton process. The facility pressure treats wood in one of two pressure retorts that are eight feet in diameter and 147 feet in length. One retort is used exclusively for treating with pentachlorophenol and the other is used for both pentachlorophenol and creosote. The preservative solution is moderately heated in storage tanks using indirect steam. In the preservative application step, the preservative mixture is transferred to the retort while the retort is subjected to high pressure, in a procedure known as the Rueping process. The preservative application step is followed by a final steaming cycle and a final stripping step under vacuum to remove excess oil and dry the wood surface.

The facility treats a small number of utility poles in an open tank (known as a butt tank) by a thermal process. The poles are placed in the tank of preservative solution and conditioned by heating the preservative to 200°F. After conditioning, the hot preservative is pumped out and replaced with a cold preservative solution that is then taken up by the conditioned wood. The facility also performs ancillary operations including cutting, drilling, and debarking green wood and storing untreated and treated wood.

Sources of wastewater at the facility are tree sap and moisture removed from the wood during conditioning and storm water. Storm water is collected from the drip pads in front of the retorts and from sumps in the retort and storage tank areas. The facility disposes of wastewater by evaporation and has no discharge. A schematic diagram of the process and wastewater treatment system at Facility B is shown in Figure IV-2.

The plant has separate treatment systems for wastewater generated by pentachlorophenol preservation and that generated by creosote preservation. Vapors from the retorts are condensed and stored in hot wells. The pentachlorophenol wastewater is gravity fed to an oil/water separator somewhat like a circular clarifier and then piped to a single stage separator box. The recovered pentachlorophenol mixture is recycled to the process. Following the separator box, the water is pumped to a cooling tower for evaporation or to the condensers for use as a coolant. The creosote wastewater is treated in a cylindrical tank separator followed by a four-stage API type separator. The recovered creosote is reused in the process and the water is pumped to the cooling tower.

The facility does not blow down cooling water from the cooling tower tank. Almost no sediment collects in the cooling tower tank because the facility continuously filters the preservative solution in the storage/work tanks through a filter press to remove solids. The filter press solids are disposed of as hazardous waste. Additionally,

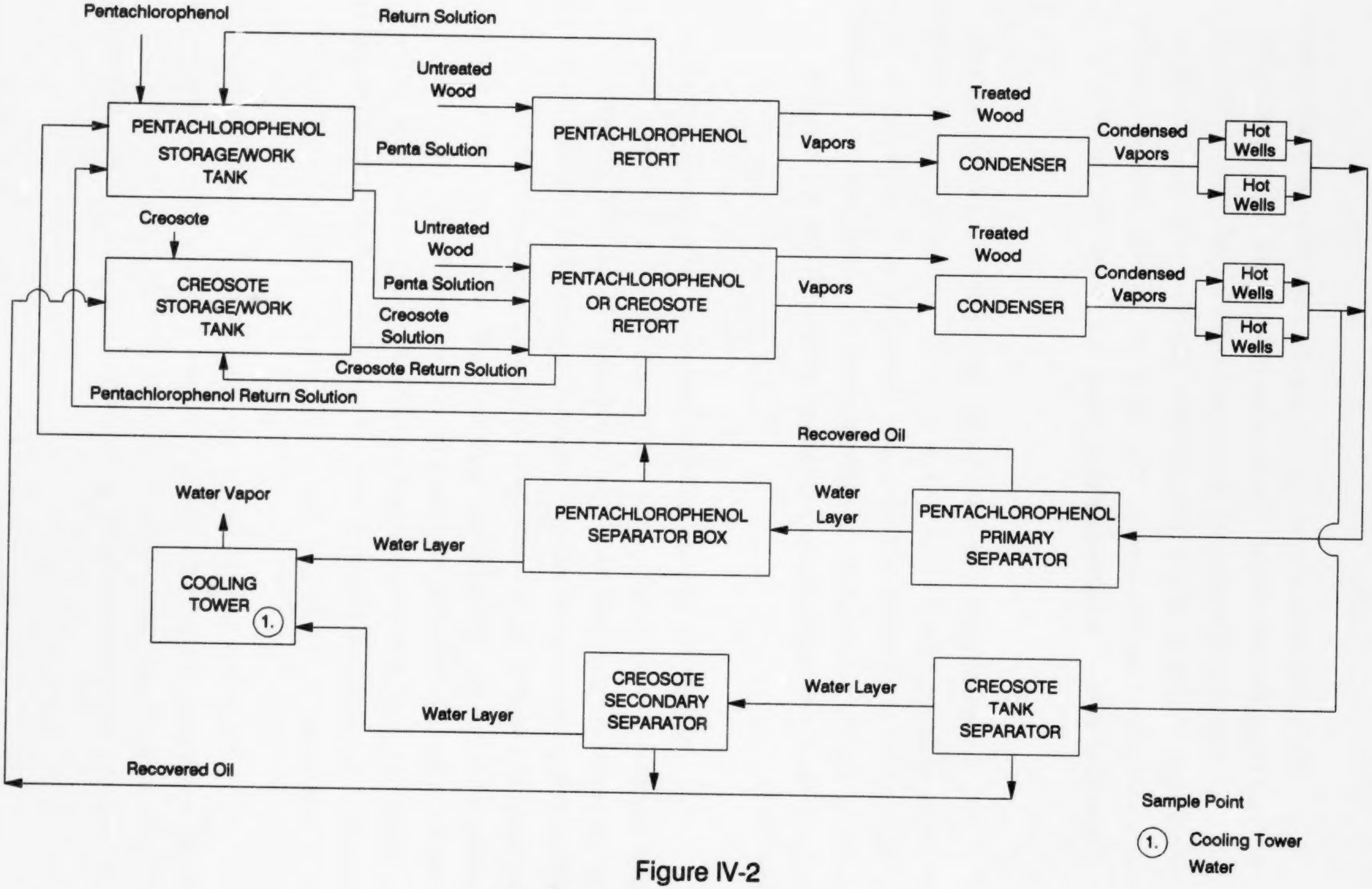
Pentachlorophenol
Return Solution
Untreated Wood
PENTACHLOROPHENOL STORAGE/WORK TANK
Penta Solution
PENTACHLOROPHENOL RETORT
Treated Wood
Vapors
CONDENSER
Condensed Vapors
Hot Wells
Hot Wells
Creosote
Untreated Wood
CREOSOTE STORAGE/WORK TANK
Penta Solution
Creosote Solution
PENTACHLOROPHENOL OR CREOSOTE RETORT
Treated Wood
Vapors
CONDENSER
Condensed Vapors
Hot Wells
Hot Wells
Creosote Return Solution
Pentachlorophenol Return Solution
Recovered Oil
Water Vapor
PENTACHLOROPHENOL SEPARATOR BOX
Water Layer
PENTACHLOROPHENOL PRIMARY SEPARATOR
Water Layer
COOLING TOWER
1.
CREOSOTE SECONDARY SEPARATOR
Water Layer
CREOSOTE TANK SEPARATOR
Water Layer
Recovered Oil
Sample Point
1. Cooling Tower Water

Figure IV-2
Facility B - Process Flow Schematic

the facility has an effective dust control program that includes vacuuming the wood after cutting or drilling to prevent solids from getting into the preservative solution.

One grab sample of the cooling tower water was collected at Facility B. The sample was dipped from the surface of the cooling water in the collection tank below the cooling tower. The water was a yellowish-brown color but the presence of free oil was not observed. A summary of the analytical results for this sample is presented in Table IV-2 at the end of this section.

The concentration of oil and grease in the cooling tower water at Facility B was 160 mg/l and the concentration of pentachlorophenol was 30,745 ug/l. Overall, the concentrations of semivolatile organic, metal, and conventional pollutants and dioxins/furans were higher in the cooling tower water at Facility B than in the final treated wastewater from any of the other facilities sampled. The concentration of pesticides/herbicides was lower in the cooling tower water at the Facility B than in the final treated wastewater from any of the other facilities sampled with the exception of Facility D. The concentration of volatile organic pollutants in the cooling tower water at Facility B was higher when compared to final effluent samples from some of the other facilities and lower when compared to others.

3. Wood Preserving Facility C (Boulton Subcategory)

This facility, located in the Pacific Northwest, treats poles, lumber, shaped products, plywood, pilings, and playground equipment. Ninety percent of the facility's product is treated poles. The facility produces approximately 5.7 million cubic feet of treated Douglas fir, western red cedar, and pine per year.

Facility C treats wood with organic preservatives including creosote, pentachlorophenol, and copper naphthanate, and waterborne preservatives including hromated copper arsenate (CCA). The facility has six pressure retorts ranging in length from 60 to 180 feet. One of the retorts is used only for CCA preservation, and the other five may be used with any preservative, including CCA.

The facility uses the Boulton process followed by pressure treatment for conditioning and treating wood with organic preservatives. The preservative solutions used are a creosote/coal tar mixture, a solution of three to five percent pentachlorophenol dissolved in a light aromatic hydrocarbon solvent, and copper naphthanate dissolved in a petroleum solvent. The facility may also treat wood with a mixture of creosote and pentachlorophenol.

Wood that is to be treated with waterborne preservatives is first conditioned by air drying or kiln drying. The wood is then placed in a retort, and the retort is filled with preservative solution then pressurized to drive the preservative into the wood.

Sources of wastewater at the facility are tree sap and moisture removed from the wood during the Boulton conditioning process in which creosote and/or pentachlorophenol are used, storm water and drippage. Storm water and drippage are collected from the drip pads in front of the retorts and from sumps in the retort area, the storage tank farm, and the wastewater treatment area. The facility has four different oil/water separation systems: one for collected storm water and drippage, one for wastewaters generated by the creosote treatment process, one for wastewaters generated by the pentachlorophenol treatment process, and one for wastewaters from the combined use of creosote and pentachlorophenol. Wastewater from all four oil/water separation systems is treated in the facility's biological treatment system. All wastewater generated during treatment with waterborne preservatives is reused.

Collected storm water and drippage are pumped to a Monarch oil/water separator. Monarch separators achieve separation by coalescing oil on treated plates with subsequent gravity separation. The separated water fraction is pumped to the facility's biological treatment system, and the oil fraction is returned to a work tank for reuse.

Wastewater from the creosote treatment process flows through one of two 8,000 gallon heated storage tanks and then to a five-stage API type oil/water separator. The oil fraction is piped to a work tank for reuse. The water fraction is pumped to a secondary Monarch separator. The oil fraction from the secondary separator is also returned to a work tank, and the water fraction flows to the facility's biological treatment system.

Wastewater from the pentachlorophenol treatment process flows through a different primary oil/water separator. The oil fraction is piped to a work tank for reuse and the water fraction is pumped to a secondary Monarch separator. The oil fraction from the secondary separator is returned to a work tank. The water fraction from the secondary separator flows through an additional separator and then to the facility's biological treatment system.

The facility also has separate primary and secondary oil/water separators for wastewater from the occasional combined use of creosote and pentachlorophenol. Wastewater from all of the facility's secondary separators is combined and pumped to the biological treatment system, at a flow rate of approximately 10,000 gallons per day. A schematic diagram of the biological treatment system is shown in Figure IV-3.

The biological treatment system consists of, in sequence, two equalization tanks, a two-stage anaerobic digester, two aerobic activated sludge tanks, a gravity clarifier, and a dissolved air flotation (DAF) clarifier. Wastewater from the DAF clarifier is pumped to a holding tank, then to a storage tank, and finally to a cooling tower for evaporation. Cooling tower blowdown is routed back to the gravity clarifier. The facility does not discharge any wastewater.

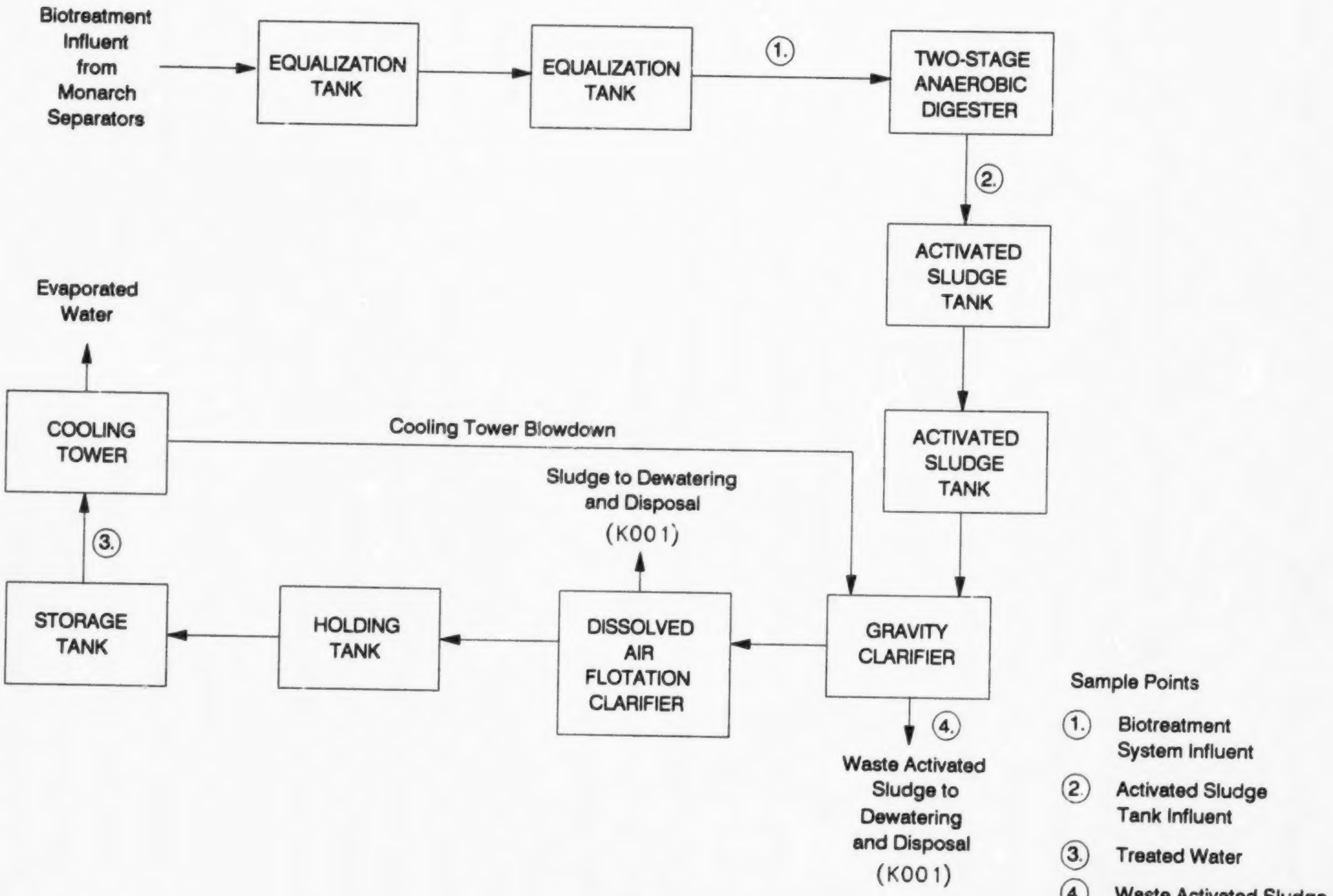
Biotreatment Influent from Monarch Separators
EQUALIZATION TANK
EQUALIZATION TANK
①.
TWO-STAGE ANAEROBIC DIGESTER
②.
ACTIVATED SLUDGE TANK
ACTIVATED SLUDGE TANK
GRAVITY CLARIFIER
④.
Waste Activated Sludge to Dewatering and Disposal (K001)
DISSOLVED AIR FLOTATION CLARIFIER
Sludge to Dewatering and Disposal (K001)
HOLDING TANK
STORAGE TANK
③.
COOLING TOWER
Evaporated Water
Cooling Tower Blowdown
Sample Points
①. Biotreatment System Influent
②. Activated Sludge Tank Influent
③. Treated Water
④. Waste Activated Sludge

Figure IV-3
Facility C - Wastewater Treatment System Schematic

Sludge from the bottom of the gravity clarifier and the top of the DAF clarifier is piped to a sludge thickening tank. Polymer is added to the thickening tank to aid in dewatering of the sludge. After settling in the thickening tank, the sludge is dewatered in a filter press. The filter cake is a K001 hazardous waste and is appropriately disposed.

Three samples each of the influent to the biological treatment system, the influent to the activated sludge tanks, and the treated wastewater from the biological treatment system were collected at this facility. A duplicate sample of the treated wastewater from the biological treatment system and a sample of the activated sludge were also collected. Sample collection locations are shown on Figure IV-3. Samples were collected over three consecutive 24-hour sample periods. Facility C has a continuous wastewater flow, and all samples at Facility C were 24-hour composites collected at four hour intervals rather than grab samples. A summary of the analytical results for the sampling episode is presented in Table IV-3 at the end of this section.

Although Facility C does not discharge wastewater, the treated wastewater from the biological treatment system meets the current effluent guidelines for Boulton subcategory facilities. The concentration of oil and grease in the influent to the biological treatment system ranged from 15 to 18 mg/l, and the concentration in the treated wastewater from the biological treatment system ranged from 5 to 6.7 mg/l. In contrast, the concentration of pentachlorophenol generally increased across the biological treatment system; the biological treatment influent concentrations ranged from 1,874 to 2,209 ug/l and the concentration in the treated wastewater from the biological treatment system ranged from <50 to 3,727 ug/l.

Components of creosote that were detected in the wastewater at Facility C include acenaphthene, biphenyl, carbazole, dibenzofuran, fluoranthene, fluorene, 2-methylnaphthalene, naphthalene, and pyrene. The concentrations of these pollutants in the treated wastewater from the biological treatment system were lower than the concentrations in the influent to the biological treatment system for all samples analyzed.

Effluent sample concentrations of metals were generally lower than their respective concentrations in the influent samples. However, for the third sampling period, the effluent sample concentrations of metals were generally higher than their respective concentrations in the influent samples. Dioxins/furans and pesticides/herbicides were analyzed in only one sample, an effluent sample, on the first day of sampling.

4. Wood Preserving Facility D (Boulton Subcategory)

This southern wood preserving facility pressure treats sawn hardwood timber using a coal tar creosote. The facility treats approximately three million cubic feet of timber per year. The wood is 85 percent red oak or white oak and is primarily used for railroad ties.

Most of the wood treated by the facility is air dried for eight to twelve months prior to treatment, although the facility may also condition and treat green wood using the Boulton process. The wood is pressure treated in one of three retorts that are each eight feet in diameter and 104 feet in length. The primary preservative application process is a type of empty-cell process known as the Rueping process. In this process, the retort is charged with wood, closed, and subjected to 30 to 40 psi of air pressure. Once the retort is under pressure, it is filled with creosote. The pressure is then raised to 180 psi and the creosote is heated to 180°F. The creosote is heated indirectly by steam in closed coils located in the bottom of the pressure retorts. There is no contact of the steam or the steam condensate with the wood or creosote. After the pressure treatment cycle, the creosote is pumped out of the cylinder and returned to a storage tank. The wood is then placed under vacuum by a vacuum pump to draw excess creosote, or "kickback" out of the wood prior to removing it from the retort. The final vacuum cycle lasts from one to two hours.

Following preservation, the wood is removed from the retort and allowed to stand on a drip pad for four to six hours. The drip pad collects drippage from the treated wood as well as some creosote that spills from the retort as the wood is unloaded. The drip pad is washed down daily with steam and water. The washdown water and any rain water falling on the drip pad drain to a storm water collection pump station and are then pumped to the preservative recovery system by a level-activated pump.

Sources of process water at the facility are condensed vapors generated from the Boulton conditioning process, process area storm water and washdown water collected from the drip pad, and storm water collected in the tank farm areas. All process waters are collected in sumps and routed to the preservative recovery system consisting of a primary oil/water separator and two identical parallel secondary oil/water separators. The wastewater stream from the secondary oil/water separators is routed to four 15,000 gallon equalization basins prior to discharge through a flow metering system to a municipal wastewater collection system. A schematic diagram of the process, preservative recovery system, and wastewater treatment system is shown in Figure IV-4.

All process water from the facility is pumped to the primary oil/water separator for gravity separation of the creosote and water fractions. Process water from the primary separator is pumped, with added polymers, to two secondary oil/water separators in parallel. Effluent from the secondary separators discharges to a series of four open-top equalization basins. Wastewater flows from the equalization basins to a holding sump and, when the sump is full, to a flow metering station that discharges to the municipal sewer. Creosote recovered in the primary and secondary separators is reused in the wood treating process.

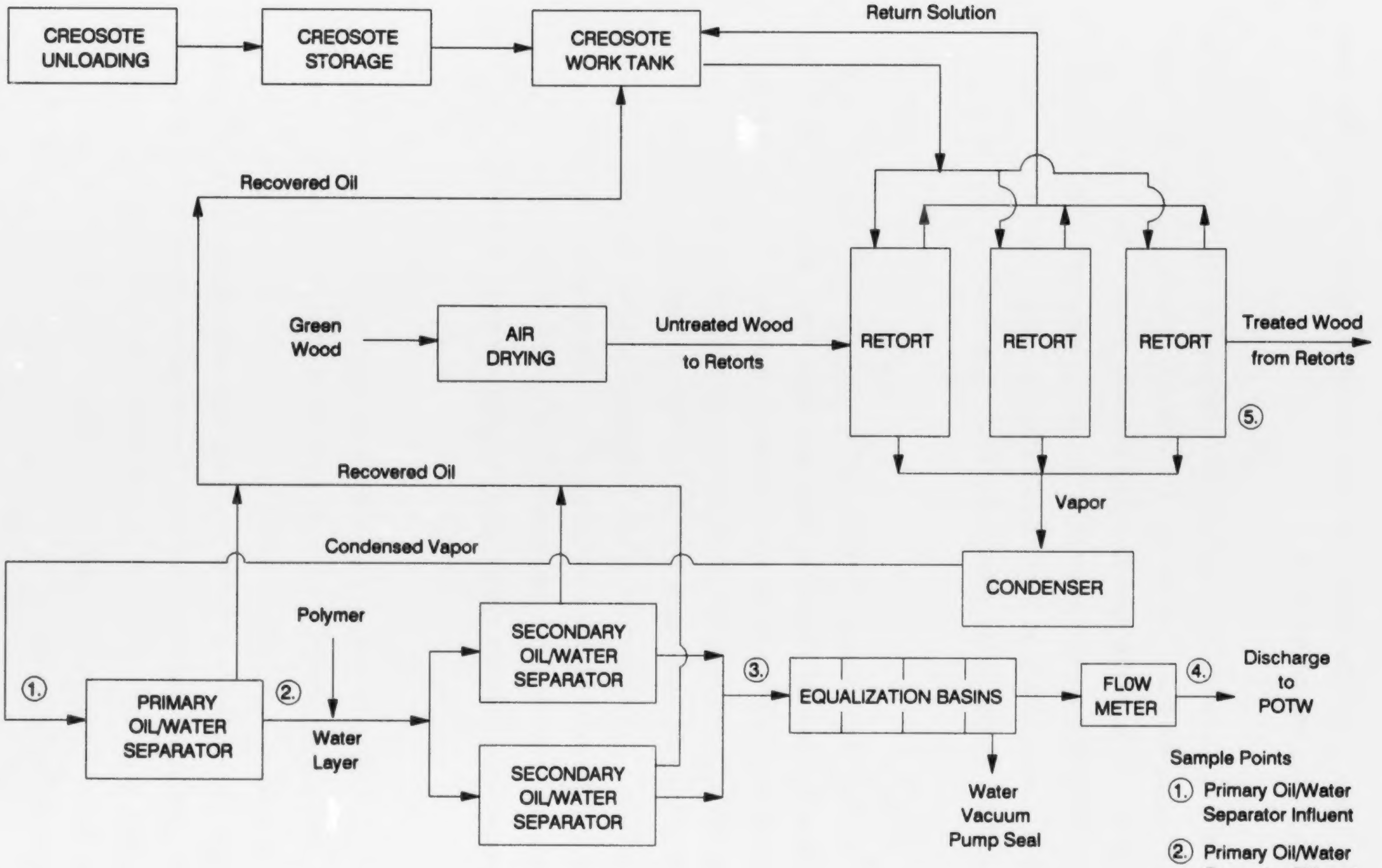
CREOSOTE UNLOADING
CREOSOTE STORAGE
CREOSOTE WORK TANK
Return Solution
Recovered Oil
Green Wood
AIR DRYING
Untreated Wood to Retorts
RETORT
RETORT
RETORT
Treated Wood from Retorts
⑤
Recovered Oil
Vapor
Condensed Vapor
CONDENSER
Polymer
①
PRIMARY OIL/WATER SEPARATOR
②
Water Layer
SECONDARY OIL/WATER SEPARATOR
SECONDARY OIL/WATER SEPARATOR
③
EQUALIZATION BASINS
Water Vacuum Pump Seal
FLOW METER
④
Discharge to POTW
Sample Points
① Primary Oil/Water Separator Influent
② Primary Oil/Water Separator Effluent
③ Secondary Oil/Water Separator Effluent
④ Final Effluent
⑤ Retort Sludge

Figure IV-4
Facility D - Process Flow Schematic

Steam and hot water from the pressure retort steam coils are collected and sent through a condenser. The hot water is then piped to cooling basins and discharged to the first of the four equalization basins. Water for use as vacuum pump seal water is recycled from the fourth equalization basin back to the production process and is discharged to the preservative recovery system after use. The facility effluent discharge rate is between 6,000 and 30,000 gallons of wastewater daily.

Storm water runoff from untreated and treated wood storage areas is collected in runoff ditches and discharged to a storm water ditch outside the facility without undergoing treatment.

Samples were collected over three consecutive 24-hour sample periods at this facility. All samples were 24-hour composites collected at four hour intervals. During the first and third sampling periods, samples were collected from the discharge trough of the primary oil/water separator (sample point 2) and from the flow monitoring pit prior to discharge to the sewer (final effluent sample point 4). During the second sampling period, samples were collected from the primary oil/water separator inlet pipe (sample point 1) and discharge trough (sample point 2), from the discharge point of one of the two secondary oil/water separators (sample point 3) and from the flow monitoring pit (sample point 4). A sample of sludge was collected from the pit into which the sump in the drip track in front of the pressure retorts drains (sample point 5). Sample collection locations are shown on Figure IV-4. A summary of the analytical results for the sampling episode is presented in Table IV-4 at the end of this section.

The final effluent for Facility D met the existing discharge limits for oil and grease, arsenic, chromium, and copper. There was a decrease in the concentration of oil and grease, copper, and arsenic in the final effluent samples compared to the concentration in the influent to the primary separator. Chromium was not detected in the influent or effluent samples.

Components of creosote detected in the wastewater at Facility D included acenaphthene, anthracene, biphenyl, carbazole, chrysene, dibenzofuran, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene, 1-methylphenanthrene, and 2-methylnaphthalene. There was a decrease in the concentration of these pollutants in the effluent samples compared to the influent sample with the exception of carbazole, fluoranthene, phenanthrene, and 2-methylnaphthalene, which were present at higher concentrations in the effluent samples than in the influent sample.

The concentration of metals in the effluent sample was three times higher than in the primary separator influent sample during the second sampling period. Dioxins/furans and pesticides/herbicides were analyzed in only one sample, a final effluent sample.

5. Wood Preserving Facility E (Steam Subcategory)

This southern wood preserving facility treats southern yellow pine using pentachlorophenol. The facility produces approximately 85,000 cubic feet of treated telephone and utility poles per month.

Wood treated by Facility E is air dried for one week to six months prior to steam conditioning and pressure treatment in one of two retorts eight feet in diameter and 90 feet in length. The facility uses modified closed steaming to condition their wood. Upon completion of the steaming cycle, a vacuum is applied to the retort to remove moisture from the wood and contaminated steam condensate. The preservative solution is then forced into the wood using the "full cell" pressure treatment process. Following the injection step, the wood is held in the retort for several hours so that as much excess preservative solution as possible can be collected and returned to the work tanks.

Sources of wastewater at the facility include sap water removed from the wood during steam conditioning, contaminated steam condensate from the conditioning process, drippage from the retorts when the retorts are opened to remove treated product, and precipitation water that falls in the work area (the area around the retorts). These wastewaters are collected and treated. The facility stores both treated and green wood in uncovered storage areas. Storm water falling in the storage areas is not controlled and flows off the property.

Preservative left in the retorts after a treatment cycle is completed is drained to one of two sumps which are used to separate the pentachlorophenol solution from the water. The pentachlorophenol solution is returned to the work tank, and the water is piped to a holding tank. Any oily layer in the holding tank is also returned to the work tank. Sap water, steam condensate, drippage, and storm water collected in the retort area are also drained to the sumps for separation.

Wastewater from the holding tank is drained to a spray cooling system in which wastewater is cycled through spray nozzles into a concrete-lined tank for cooling. Some of the spray cooling system wastewater is pumped through a barometric condenser to provide water for steaming of the retorts. Some evaporation occurs from the spray cooling system, but water does accumulate in the tank. When the level of wastewater in the tank is too high, water is withdrawn from the tank and pumped to the facility's wastewater treatment system. When the overall flow of wastewater is high, as in the winter months, excess wastewater is pumped to two holding tanks for storage prior to entering the facility's wastewater treatment system. The facility does not have accurate flow measurements to determine a water balance around the spray cooling system.

The facility's wastewater treatment system consists of, in sequence, a flocculation tank, a settling tank, a filter tank, a temper tank, and a BioTrol packed submerged film bioreactor, as shown in Figure IV-5. Bacteria, nutrients, and caustic are added to the wastewater in the temper tank to produce an optimum environment for

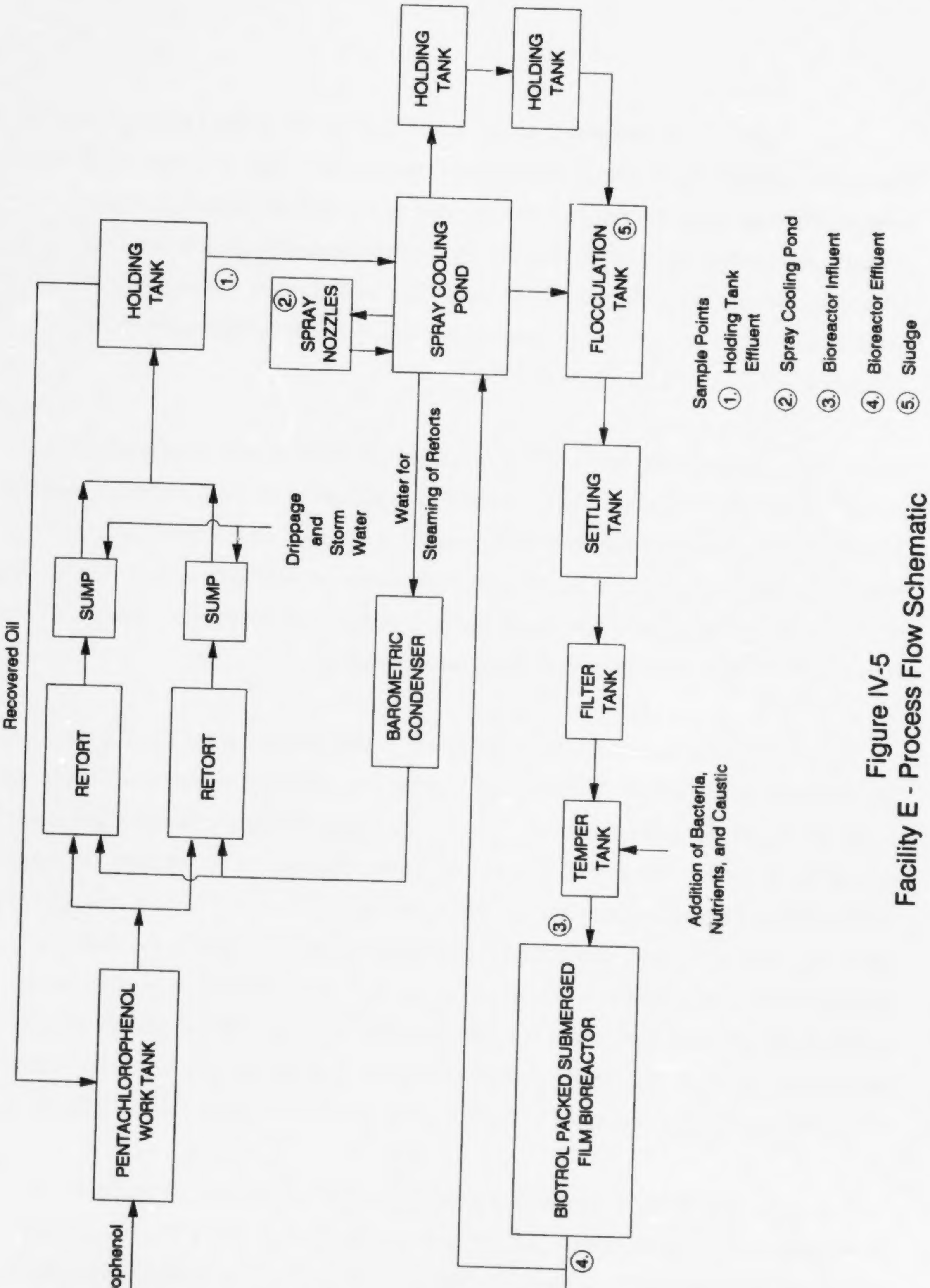
Pentachlorophenol
PENTACHLOROPHENOL WORK TANK
Recovered Oil
RETORT
RETORT
SUMP
SUMP
Drippage and Storm Water
HOLDING TANK
1.
2. SPRAY NOZZLES
SPRAY COOLING POND
Water for Steaming of Retorts
BAROMETRIC CONDENSER
HOLDING TANK
HOLDING TANK
FLOCCULATION TANK
5.
SETTLING TANK
FILTER TANK
TEMPER TANK
Addition of Bacteria, Nutrients, and Caustic
3.
BIOTROL PACKED SUBMERGED FILM BIOREACTOR
4.
Discharge to POTW or Holding Tank Truck
Sample Points
1. Holding Tank Effluent
2. Spray Cooling Pond
3. Bioreactor Influent
4. Bioreactor Effluent
5. Sludge

Figure IV-5
Facility E - Process Flow Schematic

biological treatment. At the time of the sampling episode, the effluent from the bioreactor was being routed back to the spray cooling pond for recycling or evaporation while the facility waited for approval to discharge to the local POTW.

Samples were collected at four locations over three consecutive 24-hour sample periods at this facility. All samples were 24-hour composites collected at four hour intervals. Sample collection locations are shown on Figure IV-5. During all three sampling periods, samples were collected from the discharge line of the main holding tank (sample point 1), from one of the three spray nozzles for the spray cooling pond (sample point 2), from a tap on the temper tank (bioreactor influent sample point 3), and from the discharge hose of the bioreactor (sample point 4). During the second sampling period, a duplicate sample of the bioreactor effluent (sample point 4) and a duplicate sample of the water in the spray cooling pond (sample point 2) were collected for quality assurance/quality control purposes. In addition to the samples described above, a grab sample of the sludge from the top of the flocculation tank (sample point 5) was collected during the third sampling period. A summary of the analytical results for the sampling episode is presented in Table IV-5 at the end of this section.

Although Facility E was not discharging process wastewater at the time of the sampling episode, the bioreactor effluent met the existing discharge limits for oil and grease, arsenic chromium, and copper. There was a decrease in the concentration of oil and grease, copper, and arsenic in the bioreactor effluent samples compared to the concentration in the influent to the wastewater treatment system, the discharge from the holding tank. Chromium was not detected in the holding tank discharge or bioreactor effluent samples.

The concentration of pentachlorophenol generally decreased in the bioreactor effluent samples compared to the holding tank discharge samples. The concentration of pentachlorophenol in the holding tank discharge ranged from <50 to 38,373 ug/l and the concentration in the bioreactor effluent was <50 ug/l.

Effluent sample concentrations of metals were generally higher than their respective concentrations in the influent samples. Dioxins/furans and pesticides/herbicides concentrations were lower in the effluent samples than in the influent samples.

Table IV-1
Summary of Reported Analytical Results
Wood Preserving Facility A

Pollutant Category and Pollutant	Units	Oil/Water Separator Influent S. P. 1 Day 1	Oil/Water Separator Influent S. P. 1 Day 2	Oil/Water Separator Effluent S. P. 2 Day 1	Oil/Water Separator Effluent S. P. 2 Day 2
Volatile Organics					
Acetone	ug/l	< 50	< 50	1,568	2,019
alpha-Terpineol	ug/l	156	158	< 10	195
Benzene	ug/l	69	50	38	2,264
Chloromethane	ug/l	106	56	< 50	< 50
Ethylbenzene	ug/l	443	650	256	375
m-Xylene	ug/l	430	570	401	410
Methylene chloride	ug/l	< 10	203	< 10	10
N-Nitrosodiphenylamine	ug/l	67	185	< 20	< 20
o+p-Xylene	ug/l	240	322	229	50
Toluene	ug/l	90	549	87	95
2-Butanone (MEK)	ug/l	125	163	93	99
2-Hexanone	ug/l	53	< 50	< 50	< 50
Semivolatile Organics					
Acenaphthene	ug/l	88	174	29	19
Benzenethiol	ug/l	< 10	< 10	59	< 10
bis(2-Chloroethoxy)methane	ug/l	91	< 10	< 10	< 10
bis(2-Ethylhexyl)phthalate	ug/l	< 10	< 10	< 10	73
bis(2-Chloroethyl)ether	ug/l	< 10	206	< 10	< 10
Carbazole	ug/l	101	47	46	43
Dibenzofuran	ug/l	60	80	< 10	< 10
Diphenylamine	ug/l	188	< 10	< 10	< 10
Fluoranthene	ug/l	24	50	< 10	< 10
Fluorene	ug/l	106	< 10	33	20
n-Decane	ug/l	< 10	46	< 10	< 10
n-Docosane	ug/l	99	175	34	16
n-Dodecane	ug/l	131	< 10	29	< 10
n-Eicosane	ug/l	133	259	84	35
n-Hexacosane	ug/l	< 10	45	< 10	< 10
n-Hexadecane	ug/l	137	202	52	24
N-Nitrosomethylphenylamine	ug/l	< 99	< 99	< 99	728
n-Octadecane	ug/l	149	289	60	31
n-Tetracosane	ug/l	87	178	27	10
n-Tetradecane	ug/l	133	251	< 10	< 10

Table IV-1 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility A

Pollutant Category and Pollutant	Units	Oil/Water Separator Influent S. P. 1 Day 1	Oil/Water Separator Influent S. P. 1 Day 2	Oil/Water Separator Effluent S. P. 2 Day 1	Oil/Water Separator Effluent S. P. 2 Day 2
Semivolatile Organics (continued)					
Naphthalene	ug/l	349	546	233	249
o-Cresol	ug/l	855	585	281	477
o-Toluidine	ug/l	522	< 10	205	283
p-Cresol	ug/l	1,487	1,437	914	1,028
p-Cymene	ug/l	104	442	< 10	171
Pentachlorophenol	ug/l	4,751	4,124	7,237	5,053
Pentamethylbenzene	ug/l	130	< 10	< 10	< 10
Phenanthrene	ug/l	< 10	156	76	38
Phenol	ug/l	1,156	1,103	509	578
Pyrene	ug/l	40	109	< 10	< 10
2-Chloronaphthalene	ug/l	89	< 10	< 10	< 10
2-Methylnaphthalene	ug/l	533	1,276	289	259
2,4-Dimethylphenol	ug/l	294	< 10	112	141
3,6-Dimethylphenanthrene	ug/l	117	259	72	14
4-Nitrobiphenyl	ug/l	45	114	< 10	< 10
Dioxins/Furans					
2,3,7,8-TCDD	ppq	< 64	< 48	< 15	< 6
1,2,3,7,8-PeCDD	ppq	122	mpc 96	101	66
1,2,3,4,7,8-HxCDD	ppq	349	mpc 373	280	240
1,2,3,6,7,8-HxCDD	ppq	14,700	17,300	8,440	4,430
1,2,3,7,8,9-HxCDD	ppq	1,390	1,350	1,060	753
1,2,3,4,6,7,8-HpCDD	ppq	> 60,500	> 106,000	> 43,700	> 33,200
OCDD	ppq	> 850,000	> 1,370,000	> 600,000	> 194,000
2,3,7,8-TCDF	ppq	125	< 126	< 45	< 13
1,2,3,7,8-PeCDF	ppq	615	191	90	51
2,3,4,7,8-PeCDF	ppq	58	70	40	23
1,2,3,4,7,8-HxCDF	ppq	3,960	4,720	1,840	934
1,2,3,6,7,8-HxCDF	ppq	424	432	243	138
2,3,4,6,7,8-HxCDF	ppq	270	249	155	114
1,2,3,7,8,9-HxCDF	ppq	386	300	< 11	< 5
1,2,3,4,6,7,8-HpCDF	ppq	> 36,700	> 36,100	> 20,300	> 16,500
1,2,3,4,7,8,9-HpCDF	ppq	> 21,400	> 25,300	10,100	4,940
OCDF	ppq	> 520,000	> 827,000	> 380,000	> 110,000
Total TCDD	ppq	< 65	< 240	< 176	< 13
Total PeCDD	ppq	241	< 96	216	159

Table IV-1 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility A

Pollutant Category and Pollutant	Units	Oil/Water Separator Influent S. P. 1 Day 1	Oil/Water Separator Influent S. P. 1 Day 2	Oil/Water Separator Effluent S. P. 2 Day 1	Oil/Water Separator Effluent S. P. 2 Day 2
Dioxins/Furans (continued)					
Total HxCDD	ppq	24,300	26,800	17,300	9,880
Total HpCDD	ppq	> 205,000	> 169,000	> 82,100	> 60,800
Total OCDD	ppq	> 850,000	> 1,370,000	> 600,000	> 194,000
Total TCDF	ppq	1,300	< 518	< 165	99
Total PeCDF	ppq	1,860	1,270	877	767
Total HxCDF	ppq	45,000	41,400	12,200	17,500
Total HpCDF	ppq	> 127,000	> 136,000	> 66,700	> 51,800
Total OCDF	ppq	> 520,000	> 830,000	> 380,000	> 110,000
Pesticides/Herbicides					
Captan	ppt	1,080	< 1,000	< 1,000	1,440
Diallate	ppt	3,800	< 1,000	1,080	< 1,000
Heptachlor	ppt	280	< 200	< 200	< 200
Heptachlor epoxide	ppt	1,080	1,080	1,320	920
Dieldrin	ppt	< 100	< 100	400	< 100
Endosulfan I	ppt	< 500	960	< 500	360
Endosulfan II	ppt	< 100	< 100	600	< 100
Metals					
Aluminum	ug/l	412	457	1,030	757
Antimony	ug/l	< 6.0	19.4	< 6.0	< 6.0
Arsenic	ug/l	< 2.0	< 20.0	2.2	3.9
Barium	ug/l	28	28	45	35
Boron	ug/l	82	46	39	124
Calcium	ug/l	5,530	7,050	12,000	9,920
Copper	ug/l	126	119	100	82
Iron	ug/l	5,210	6,220	26,600	23,200
Magnesium	ug/l	989	1,260	1,900	1,740
Manganese	ug/l	161	178	327	258
Sodium	ug/l	6,710	8,400	12,300	9,800
Thallium	ug/l	< 20.0	4	< 2.0	< 20.0
Zinc	ug/l	839	1,120	1,510	1,170

Table IV-1 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility A

Pollutant Category and Pollutant	Units	Oil/Water Separator Influent S. P. 1 Day 1	Oil/Water Separator Influent S. P. 1 Day 2	Oil/Water Separator Effluent S. P. 2 Day 1	Oil/Water Separator Effluent S. P. 2 Day 2
Semi-quantitative Metals					
Silicon	mg/l	1.0	1.0	1.9	1.9
Sulfur	mg/l	5.4	5.4	7.3	6.6
Conventionals					
BOD	mg/l	340	370	380	220
Oil & Grease	mg/l	120	95	66	28
TSS	mg/l	18	55	35	26
Nonconventionals					
Ammonia, as N	mg/l	0.54	0.50	0.66	0.50
Chloride	mg/l	13	11	29	22
COD	mg/l	820	1,100	650	570
Corrosivity	mpy	13	11	< 10	< 10
Flash Point	°C	65	> 65	> 65	> 65
Nitrogen, Total Kjeldahl	mg/l	0.58	1.10	1.1	1.80
Nitrate + Nitrite, as N	mg/l	0.078	0.12	0.11	0.050
Phosphorus, Total as P	mg/l	0.42	1.1	1.8	0.92
Specific Conductance	umho/cm-25 °C	140	170	200	120
Sulfate	mg/l	2.2	4.2	8.1	16.0
TDS	mg/l	97	140	230	180
TOC	mg/l	240	190	180	150

<	Indicates compound was analyzed for but not detected. Reported with detection limit value.
>	Indicates saturated detector response. The concentration shown has been estimated from the data available and should be considered a minimum value.
mpc	Not detected. A response was noted but qualitative criteria were not met. The number reported is the maximum possible concentration calculated from the observed data.
ug/l	microgram per liter
mg/l	milligram per liter
ppt	part per trillion
ppq	part per quadrillion
mpy	millimeter per year

Table IV-2
Summary of Reported Analytical Results
Wood Preserving Facility B

Pollutant Category and Pollutant	Units	Cooling Tower Condensate Day 1
Volatile Organics		
Acetone	ug/l	665
alpha-Terpineol	ug/l	388
Ethyl methanesulfonate	ug/l	3,952
Semivolatile Organics		
Acenaphthylene	ug/l	666
Benzo(a)anthracene	ug/l	65
Benzoic acid	ug/l	34,680
Fluoranthene	ug/l	268
Hexanoic acid	ug/l	15,430
n-Decane	ug/l	418
n-Eicosane	ug/l	103
n-Hexadecane	ug/l	249
N-Nitrosopiperidine	ug/l	333
n-Octadecane	ug/l	191
n-Tetradecane	ug/l	79
p-Cresol	ug/l	1,306
p-Cymene	ug/l	267
Pentachlorophenol	ug/l	30,745
Phenanthrene	ug/l	462
Phenol	ug/l	1,236
Pyrene	ug/l	216
Tripropyleneglycol methyl ether	ug/l	10,622
2-Bromochlorobenzene	ug/l	341
2-Methylnaphthalene	ug/l	322
2,3-Benzofluorene	ug/l	417
2,4-Dimethylphenol	ug/l	274
4,5-Methylenephenanthrene	ug/l	496
Dioxins/Furans		
1,2,3,4,7,8-HxCDD	ppq	1,010
1,2,3,6,7,8-HxCDD	ppq	14,600
1,2,3,7,8,9-HxCDD	ppq	850
1,2,3,4,6,7,8-HpCDD	ppq	> 199,000
OCDD	ppq	> 1,590,000

Table IV-2 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility B

Pollutant Category and Pollutant	Units		Cooling Tower Condensate Day 1
Dioxins/Furans (continued)			
2,3,7,8-TCDF	ppq	<	299
1,2,3,4,7,8-HxCDF	ppq		2,870
1,2,3,6,7,8-HxCDF	ppq		233
2,3,4,6,7,8-HxCDF	ppq		214
1,2,3,4,6,7,8-HpCDF	ppq		57,400
OCDF	ppq	>	947,000
Total HxCDD	ppq		101,000
Total HpCDD	ppq	>	436,000
Total OCDD	ppq	>	1,590,000
Total TCDF	ppq		637
Total HxCDF	ppq		51,500
Total HpCDF	ppq	>	184,000
Total OCDF	ppq	>	947,000
Pesticides/Herbicides			
Heptachlor	ppt		1,120
Sulfotepp	ppt		1,200
Metals			
Aluminum	ug/l		4,520
Arsenic	ug/l		127
Barium	ug/l		114
Boron	ug/l		515
Cadmium	ug/l		45
Calcium	ug/l		127,000
Chromium	ug/l		214,000
Cobalt	ug/l		64
Copper	ug/l		9,440
Iron	ug/l		454,000
Magnesium	ug/l		18,400
Manganese	ug/l		12,600
Mercury	ug/l		20
Nickel	ug/l		268

Table IV-2 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility B

Pollutant Category and Pollutant	Units	Cooling Tower Condensate Day 1
Metals (continued)		
Sodium	ug/l	5,850,000
Thallium	ug/l	57
Titanium	ug/l	94
Vanadium	ug/l	24
Zinc	ug/l	34,400
Semi-quantitative Metals		
Iodine	mg/l	10.4
Iridium	mg/l	3.7
Phosphorus	mg/l	12.0
Potassium	mg/l	13.4
Ruthenium	mg/l	1.1
Silicon	mg/l	7.1
Strontium	mg/l	0.4
Sulfur	mg/l	290.0
Tantalum	mg/l	1.1
Conventionals		
BOD	mg/l	> 4,200
Oil & Grease	mg/l	160
TSS	mg/l	2,000
Nonconventionals		
Ammonia, as N	mg/l	5.7
Chloride	mg/l	750
COD	mg/l	16,000
Cyanide, Total	ug/l	290
Flash Point	°C	> 65
Fluoride	mg/l	0.34
Nitrogen, Total Kjeldahl	mg/l	55
Nitrate + Nitrite, as N	mg/l	1.3
Phosphorus, Total as P	mg/l	5.3
Specific Conductance	umho/cm-25 °C	20,000

Table IV-2 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility B

Pollutant Category and Pollutant	Units	Cooling Tower Condensate Day 1
Nonconventionals (continued)		
Sulfate	mg/l	1,100
Sulfide, Total (Iodometric)	mg/l	8.4
TDS	mg/l	5,200
TOC	mg/l	5,200

>	Indicates saturated detector response. The concentration shown has been estimated from the available data and should be considered a minimum value.
ug/l	microgram per liter
mg/l	milligram per liter
ppt	part per trillion
ppq	part per quadrillion

Table IV-3
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Bio-Treatment System Influent S. P. 1 Day 1	Bio-Treatment System Influent S. P. 1 Day 2	Bio-Treatment System Influent S. P. 1 Day 3
Volatile Organics				
Acetone	ug/l	6,879	6,559	9,674
alpha-Picoline	ug/l	< 500	5,135	< 556
alpha-Terpineol	ug/l	298	311	176
Benzene	ug/l	583	600	700
Chloroform	ug/l	1,299	1,640	1,910
Ethylbenzene	ug/l	139	145	158
m-Xylene	ug/l	232	< 10	< 10
Methylene chloride	ug/l	< 10	32	< 10
o+p-Xylene	ug/l	110	100	< 10
Pyridine	ug/l	6,056	6,309	5,402
Styrene	ug/l	220	299	198
Toluene	ug/l	< 10	348	< 10
2-Butanone (MEK)	ug/l	< 50	< 50	230
2-Hexanone	ug/l	53	< 50	< 50
4-Methyl-2-Pentanone	ug/l	63	60	67
Semivolatile Organics				
Acenaphthene	ug/l	382	461	520
Aniline	ug/l	3,095	1,854	694
Benzoic acid	ug/l	852	644	< 556
Benzyl alcohol	ug/l	< 100	< 100	1,013
Biphenyl	ug/l	148	169	192
bis(2-Chloroisopropyl)ether	ug/l	< 100	3,360	< 111
Carbazole	ug/l	203	< 200	< 222
Dibenzofuran	ug/l	241	259	258
Fluoranthene	ug/l	< 100	124	158
Fluorene	ug/l	167	186	184
Hexanoic acid	ug/l	100	100	111
n-Decane	ug/l	< 100	292	< 111
Naphthalene	ug/l	2,495	2,391	1,433
Nitrobenzene	ug/l	< 100	< 100	< 111
o-Cresol	ug/l	1,381	1,197	< 111
o-Toluidine	ug/l	262	703	< 111
p-Cresol	ug/l	1,765	1,594	1,496
Pentachlorophenol	ug/l	2,061	1,874	2,209
Phenanthrene	ug/l	361	407	455
Phenol	ug/l	< 100	< 100	10,273
Pyrene	ug/l	< 100	< 100	117
Thianapthene	ug/l	194	248	< 111
2,4,6-Trichlorophenol	ug/l	< 100	< 100	< 111

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Bio-Treatment System Influent S. P. 1 Day 1	Bio-Treatment System Influent S. P. 1 Day 2	Bio-Treatment System Influent S. P. 1 Day 3
Semivolatile Organics (Continued)				
2,4-Dimethylphenol	ug/l	< 100	544	< 111
2-Methyl-4,6-Dinitrophenol	ug/l	< 200	< 200	< 222
2-Methylnaphthalene	ug/l	960	1,004	707
2-Nitrophenol	ug/l	1,465	1,168	1,473
4-Nitrophenol	ug/l	1,548	1,334	1,710
Dioxins/Furans				
Not analyzed				
Pesticides/Herbicides				
Not anaylzed				
Metals				
Aluminum	ug/l	146.0	160.0	147.0
Antimony	ug/l	< 6.0	6.1	< 6.0
Arsenic	ug/l	371.0	361.0	373.0
Barium	ug/l	8.0	8.0	7.0
Boron	ug/l	26,600.0	23,800.0	22,600.0
Cadmium	ug/l	< 5.0	< 5.0	< 5.0
Calcium	ug/l	10,800.0	10,200.0	10,300.0
Chromium	ug/l	189.0	221.0	226.0
Copper	ug/l	2,010.0	2,010.0	1,870.0
Iron	ug/l	3,060.0	2,800.0	2,930.0
Lead	ug/l	< 50.0	< 50.0	< 50.0
Magnesium	ug/l	3,550.0	3,470.0	3,500.0
Manganese	ug/l	166.0	156.0	158.0
Mercury	ug/l	< 4.0	< 4.0	< 2.0
Nickel	ug/l	< 22.0	< 22.0	< 22.0
Selenium	ug/l	< 30.0	< 3.0	< 3.0
Silver	ug/l	< 6.0	< 6.0	< 6.0
Sodium	ug/l	52,000.0	46,400.0	43,600.0
Thallium	ug/l	< 20.0	< 20.0	24.8
Tin	ug/l	< 30.0	< 30.0	< 30.0
Titanium	ug/l	< 5.0	< 5.0	< 5.0
Zinc	ug/l	288.0	285.0	290.0

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Bio-Treatment System Influent S. P. 1 Day 1	Bio-Treatment System Influent S. P. 1 Day 2	Bio-Treatment System Influent S. P. 1 Day 3
Semi-quantitative Metals				
Iodine	mg/l	4.1	3.5	2.3
Iridium	mg/l	ND	ND	ND
Phosphorus	mg/l	6.4	5.2	4.3
Silicon	mg/l	5.1	4.5	4.6
Sulfur	mg/l	47.1	41.1	38.3
Conventionals				
BOD	mg/l	830.0	1,700.0	1,100.0
Oil & Grease	mg/l	15.0	16.0	18.0
TSS	mg/l	37.0	34.0	31.0
Nonconventionals				
Ammonia, as N	mg/l	67.0	65.0	54.0
Chloride	mg/l	41.0	32.0	31.0
COD	mg/l	3,400.0	2,900.0	4,700.0
Corrosivity	MPY	10.0	NA	NA
Flash Point	°C	> 65.0	NA	NA
Nitrate + Nitrite, as N	mg/l	15.0	15.0	12.0
Nitrogen, Total Kjeldahl	mg/l	NR	86.0	58.0
Phosphorus, Total as P	mg/l	3.0	4.2	3.8
Specific Conductance	umho/cm-25 °C	NA	920.0	860.0
Sulfate	mg/l	130.0	110.0	100.0
TDS	mg/l	370.0	340.0	330.0
TOC	mg/l	860.0	820.0	850.0

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Activated Sludge Influent S. P. 2 Day 1	Activated Sludge Influent S. P. 2 Day 2	Activated Sludge Influent S. P. 2 Day 3
Volatile Organics				
Acetone	ug/l	7,571	8,544	5,149
alpha-Picoline	ug/l	< 500	6,010	5,851
alpha-Terpineol	ug/l	373	345	204
Benzene	ug/l	502	529	599
Chloroform	ug/l	1,307	1,377	1,498
Ethylbenzene	ug/l	139	132	104
m-Xylene	ug/l	< 10	114	207
Methylene chloride	ug/l	< 10	< 10	< 10
o+p-Xylene	ug/l	< 10	115	92
Pyridine	ug/l	7,622	810	7,949
Styrene	ug/l	226	319	< 10
Toluene	ug/l	298	301	179
2-Butanone (MEK)	ug/l	< 50	< 50	< 50
2-Hexanone	ug/l	141	57	67
4-Methyl-2-Pentanone	ug/l	1,926	84	63
Semivolatile Organics				
Acenaphthene	ug/l	568	331	117
Aniline	ug/l	1,842	< 100	2,346
Benzoic acid	ug/l	22,319	12,106	17,400
Benzyl alcohol	ug/l	< 100	< 100	< 10
Biphenyl	ug/l	237	143	< 10
bis(2-Chloroisopropyl)ether	ug/l	< 100	< 100	< 10
Carbazole	ug/l	220	< 200	< 20
Dibenzofuran	ug/l	332	182	< 10
Fluoranthene	ug/l	138	< 100	< 10
Fluorene	ug/l	248	120	< 10
Hexanoic acid	ug/l	100	100	427
n-Decane	ug/l	< 100	< 100	< 10
Naphthalene	ug/l	< 100	2,266	1,764
Nitrobenzene	ug/l	< 100	< 100	< 10
o-Cresol	ug/l	1,880	1,479	684
o-Toluidine	ug/l	206	440	392
p-Cresol	ug/l	1,865	2,083	3,856
Pentachlorophenol	ug/l	< 500	2,752	< 50
Phenanthrene	ug/l	435	217	< 10
Phenol	ug/l	< 100	< 100	< 10
Pyrene	ug/l	160	< 100	< 10
Thianapthene	ug/l	330	240	< 10
2,4,6-Trichlorophenol	ug/l	< 100	< 100	45

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Activated Sludge Influent S. P. 2 Day 1	Activated Sludge Influent S. P. 2 Day 2	Activated Sludge Influent S. P. 2 Day 3
Semivolatile Organics (Continued)				
2,4-Dimethylphenol	ug/l	< 100	< 100	< 10
2-Methyl-4,6-Dinitrophenol	ug/l	< 200	< 200	< 20
2-Methylnaphthalene	ug/l	1,514	1,172	866
2-Nitrophenol	ug/l	355	647	172
4-Nitrophenol	ug/l	< 500	712	97
Dioxins/Furans				
Not analyzed				
Pesticides/Herbicides				
Not analyzed				
Metals				
Aluminum	ug/l	2,000.0	362.0	1,530.0
Antimony	ug/l	6.3	< 6.0	< 6.0
Arsenic	ug/l	1,496.0	254.0	652.0
Barium	ug/l	101.0	27.0	71.0
Boron	ug/l	26,700.0	28,000.0	24,300.0
Cadmium	ug/l	< 5.0	< 5.0	< 5.0
Calcium	ug/l	11,800.0	9,170.0	11,000.0
Chromium	ug/l	2,550.0	605.0	1,870.0
Copper	ug/l	2,850.0	823.0	2,190.0
Iron	ug/l	19,300.0	4,790.0	14,200.0
Lead	ug/l	62.0	< 50.0	< 50.0
Magnesium	ug/l	4,550.0	3,660.0	4,260.0
Manganese	ug/l	314.0	115.0	251.0
Mercury	ug/l	8.0	< 4.0	5.0
Nickel	ug/l	< 22.0	< 22.0	< 22.0
Selenium	ug/l	< 30.0	3.0	< 30.0
Silver	ug/l	< 6.0	< 6.0	< 6.0
Sodium	ug/l	112,000.0	99,100.0	91,000.0
Thallium	ug/l	< 2.0	< 20.0	< 20.0
Tin	ug/l	< 30.0	< 30.0	< 30.0
Titanium	ug/l	111.0	14.0	80.0
Zinc	ug/l	855.0	243.0	633.0

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Activated Sludge Influent S. P. 2 Day 1	Activated Sludge Influent S. P. 2 Day 2	Activated Sludge Influent S. P. 2 Day 3
Semi-quantitative Metals				
Iodine	mg/l	16.7	7.0	12.1
Iridium	mg/l	1.1	ND	ND
Phosphorus	mg/l	17.8	8.0	14.1
Silicon	mg/l	6.9	5.0	6.2
Sulfur	mg/l	49.9	46.1	43.7
Conventionals				
BOD	mg/l	1,400	1,700.0	1,200.0
Oil & Grease	mg/l	10.0	16.0	27.0
TSS	mg/l	690.0	180.0	550.0
Nonconventionals				
Ammonia, as N	mg/l	81.0	93.0	63.0
Chloride	mg/l	45.0	30.0	36.0
COD	mg/l	3,300.0	3,100.0	3,000.0
Corrosivity	MPY	NA	NA	NA
Flash Point	°C	NA	NA	NA
Nitrate + Nitrite, as N	mg/l	7.2	8.8	4.8
Nitrogen, Total Kjeldahl	mg/l	110.0	76.0	91.0
Phosphorus, Total as P	mg/l	27.0	19.0	26.0
Specific Conductance	umho/cm-25 °C	NA	1,100.0	1,000.0
Sulfate	mg/l	120.0	140.0	140.0
TDS	mg/l	800.0	540.0	480.0
TOC	mg/l	840.0	760.0	780.0

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Treated Water S. P. 3 Day 1		Treated Water S. P. 3 Day 2		Treated Water S. P. 3 Day 2 *Duplicate**		Treated Water S. P. 3 Day 3	
Volatile Organics									
Acetone	ug/l	<	87	<	50	<	50	<	50
alpha-Picoline	ug/l	<	50		137		339		253
alpha-Terpineol	ug/l	<	10	<	10	<	11	<	10
Benzene	ug/l	<	10	<	10	<	11	<	10
Chloroform	ug/l	<	10	<	10	<	10	<	10
Ethylbenzene	ug/l	<	10	<	10	<	11	<	10
m-Xylene	ug/l	<	10	<	10	<	10	<	10
Methylene chloride	ug/l		29	<	10	<	10	<	10
o+p-Xylene	ug/l	<	10	<	10	<	10	<	10
Pyridine	ug/l		18	<	10	<	11		16
Styrene	ug/l	<	10	<	10	<	11	<	10
Toluene	ug/l	<	10	<	10	<	10	<	10
2-Butanone (MEK)	ug/l	<	50	<	50	<	50	<	50
2-Hexanone	ug/l	<	50	<	50	<	50	<	50
4-Methyl-2-Pentanone	ug/l	<	50	<	50	<	50	<	50
Semivolatile Organics									
Acenaphthene	ug/l	<	10	<	10	<	11	<	10
Aniline	ug/l		419		379		431		411
Benzoic acid	ug/l	<	50	<	50	<	56	<	50
Benzyl alcohol	ug/l	<	10	<	10	<	11	<	10
Biphenyl	ug/l	<	10	<	10	<	11	<	10
bis(2-Chloroisopropyl)ether	ug/l	<	10	<	10	<	11	<	10
Carbazole	ug/l	<	20	<	20	<	22	<	20
Dibenzofuran	ug/l	<	10	<	10	<	11	<	10
Fluoranthene	ug/l	<	10	<	10	<	11	<	10
Fluorene	ug/l	<	10	<	10	<	11	<	10
Hexanoic acid	ug/l	<	10	<	10	<	11	<	10
n-Decane	ug/l	<	10	<	10	<	11	<	10
Naphthalene	ug/l	<	10	<	10	<	11	<	10
Nitrobenzene	ug/l		22		18		19		20
o-Cresol	ug/l	<	10	<	10		25		22
o-Toluidine	ug/l		110		129		166		161
p-Cresol	ug/l	<	10	<	10	<	11	<	10
Pentachlorophenol	ug/l		3,219		3,727	<	56	<	50
Phenanthrene	ug/l	<	10	<	10	<	11	<	10
Phenol	ug/l	<	10	<	10	<	11	<	10
Pyrene	ug/l	<	10	<	10	<	11	<	10
Thianapthene	ug/l		27		16		23		20
2,4,6-Trichlorophenol	ug/l		44	<	10	<	11	<	10

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Treated Water S. P. 3 Day 1	Treated Water S. P. 3 Day 2	Treated Water S. P. 3 Day 2 *Duplicate**	Treated Water S. P. 3 Day 3
Semivolatile Organics (Continued)					
2,4-Dimethylphenol	ug/l	< 10	< 10	< 11	< 10
2-Methyl-4,6-Dinitrophenol	ug/l	34	35	31	39
2-Methylnaphthalene	ug/l	< 10	< 10	< 11	< 10
2-Nitrophenol	ug/l	88	85	78	85
4-Nitrophenol	ug/l	< 103	< 280	< 111	< 119
Dioxins/Furans					
2,3,7,8-TCDD	ppq	6	NA	NA	NA
1,2,3,6,7,8-HxCDD	ppq	131	NA	NA	NA
1,2,3,7,8,9-HxCDD	ppq	37	NA	NA	NA
1,2,3,4,6,7,8-HpCDD	ppq	1,780	NA	NA	NA
OCDD	ppq	17,300	NA	NA	NA
2,3,7,8-TCDF	ppq	mpc 5	NA	NA	NA
1,2,3,7,8-PeCDF	ppq	< 4	NA	NA	NA
2,3,4,7,8-PeCDF	ppq	< 3	NA	NA	NA
1,2,3,4,7,8-HxCDF	ppq	< 5	NA	NA	NA
1,2,3,6,7,8-HxCDF	ppq	< 5	NA	NA	NA
1,2,3,7,8,9-HxCDF	ppq	< 7	NA	NA	NA
2,3,4,6,7,8-HxCDF	ppq	< 6	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	ppq	675	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	ppq	50	NA	NA	NA
OCDF	ppq	4,390	NA	NA	NA
Total TCDD	ppq	< 44	NA	NA	NA
Total HxCDD	ppq	471	NA	NA	NA
Total HpCDD	ppq	3,470	NA	NA	NA
Total OCDD	ppq	17,300	NA	NA	NA
Total TCDF	ppq	< 9	NA	NA	NA
Total PeCDF	ppq	47	NA	NA	NA
Total HxCDF	ppq	643	NA	NA	NA
Total HpCDF	ppq	3,620	NA	NA	NA
Total OCDF	ppq	4,390	NA	NA	NA
Pesticides/Herbicides					
Trifuralin	ppt	6,120	NA	NA	NA

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Treated Water S. P. 3 Day 1	Treated Water S. P. 3 Day 2	Treated Water S. P. 3 Day 2 *Duplicate**	Treated Water S. P. 3 Day 3
Metals					
Aluminum	ug/l	< 90.0	< 90.0	< 90.0	1,030.0
Antimony	ug/l	< 6.0	< 6.0	< 6.0	< 6.0
Arsenic	ug/l	274.0	265.0	255.0	263.0
Barium	ug/l	7.0	6.0	6.0	70.0
Boron	ug/l	28,700.0	27,700.0	29,300.0	24,700.0
Cadmium	ug/l	< 5.0	< 5.0	< 5.0	< 5.0
Calcium	ug/l	5,110.0	5,030.0	5,510.0	115,000.0
Chromium	ug/l	54.0	40.0	47.0	1,840.0
Copper	ug/l	203.0	198.0	205.0	2,240.0
Iron	ug/l	1,220.0	564.0	751.0	13,500.0
Lead	ug/l	< 50.0	< 50.0	< 50.0	56.0
Magnesium	ug/l	2,510.0	2,540.0	2,680.0	4,470.0
Manganese	ug/l	111.0	88.0	96.0	261.0
Mercury	ug/l	< 2.0	< 2.0	< 2.0	< 2.0
Nickel	ug/l	< 22.0	< 22.0	< 22.0	< 22.0
Selenium	ug/l	< 3.0	< 30.0	< 3.0	< 3.0
Silver	ug/l	< 6.0	< 6.0	< 6.0	< 6.0
Sodium	ug/l	111,000.0	110,000.0	112,000.0	94,000.0
Thallium	ug/l	< 20.0	< 20.0	< 20.0	< 20.0
Tin	ug/l	< 30.0	< 30.0	< 30.0	< 30.0
Titanium	ug/l	< 5.0	< 5.0	< 5.0	46.0
Zinc	ug/l	78.0	53.0	54.0	724.0
Semi-quantitative Metals					
Iodine	mg/l	ND	ND	ND	13.1
Iridium	mg/l	ND	ND	ND	ND
Phosphorus	mg/l	1.6	1.4	1.2	14.4
Silicon	mg/l	4.4	4.6	4.2	5.6
Sulfur	mg/l	41.5	41.4	41.9	47.0
Conventionals					
BOD	mg/l	47.0	40.0	47.0	40.0
Oil & Grease	mg/l	5.4	5.2	5.0	6.7
TSS	mg/l	39.0	33.0	36.0	36.0

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Treated Water S. P. 3 Day 1	Treated Water S. P. 3 Day 2	Treated Water S. P. 3 Day 2 *Duplicate**	Treated Water S. P. 3 Day 3
Nonconventionals					
Ammonia, as N	mg/l	130.0	110.0	140.0	100.0
Chloride	mg/l	35.0	26.0	25.0	38.0
COD	mg/l	350.0	380.0	310.0	310.0
Corrosivity	MPY	12.0	NA	NA	NA
Flash Point	°C	> 65.0	NA	NA	NA
Nitrate + Nitrite, as N	mg/l	110.0	160.0	130.0	150.0
Nitrogen, Total Kjeldahl	mg/l	160.0	120.0	100.0	120.0
Phosphorus, Total as P	mg/l	1.4	1.1	1.0	1.0
Specific Conductance	umho/cm-25 °C	NA	1,700.0	1,700.0	1,800.0
Sulfate	mg/l	120.0	110.0	100.0	110.0
TDS	mg/l	690.0	600.0	660.0	680.0
TOC	mg/l	90.0	82.0	84.0	88.0

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* Duplicate of treated water for quality control.

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Waste Activated Sludge Total Analysis S. P. 4 Day 3	Waste Activated Sludge TCLP Analysis S. P. 4 Day 3
Volatile Organics			
None detected			
Semivolatile Organics			
Benzoic acid	ug/l	30,019	NA
Fluoranthene	ug/l	525	NA
Hexanoic acid	ug/l	439	NA
p-Cresol	ug/l	915	NA
2-Nitrophenol	ug/l	301	NA
Dioxins/Furans			
2,3,7,8-TCDD	ppq	6,310	< 2
1,2,3,4,7,8-HxCDD	ppq	< 41,000	< 10
1,2,3,6,7,8-HxCDD	ppq	< 69,500	< 12
1,2,3,7,8,9-HxCDD	ppq	< 28,800	< 7
1,2,3,4,6,7,8-HpCDD	ppq	1,580,000	134
OCDD	ppq	21,800,000	1,100
2,3,7,8-TCDF	ppq	2,280	< 1
1,2,3,4,7,8-HxCDF	ppq	< 9,720	< 5
1,2,3,6,7,8-HxCDF	ppq	< 8,940	< 4
2,3,4,6,7,8-HxCDF	ppq	< 10,900	< 5
1,2,3,7,8,9-HxCDF	ppq	< 12,600	< 6
1,2,3,4,6,7,8-HpCDF	ppq	425,000	36
1,2,3,4,7,8,9-HpCDF	ppq	376,000	< 12
OCDF	ppq	2,590,000	207
Total TCDD	ppq	6,310	< 27
Total HxCDD	ppq	120,000	< 34
Total HpCDD	ppq	3,260,000	223
Total OCDD	ppq	21,800,000	1,100
Total TCDF	ppq	51,800	< 4
Total HxCDF	ppq	369,000	60
Total HpCDF	ppq	2,110,000	36
Total OCDF	ppq	2,590,000	207
Pesticides/Herbicides			
		None detected	Not anaylzed

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Waste Activated Sludge Total Analysis S. P. 4 Day 3	Waste Activated Sludge TCLP Analysis S. P. 4 Day 3	
Metals				
Aluminum	mg/kg	5,920.0	274.0	(ug/l)
Antimony	mg/kg	7.5	< 6.0	(ug/l)
Arsenic	mg/kg	2,080.0	501.0	(ug/l)
Barium	mg/kg	207.0	1,080.0	(ug/l)
Boron	mg/kg	1,470.0	2,280.0	(ug/l)
Cadmium	mg/kg	6.0	< 5.0	(ug/l)
Calcium	mg/kg	6,950.0	6,990.0	(ug/l)
Chromium	mg/kg	5,610.0	322.0	(ug/l)
Copper	mg/kg	4,150.0	2,610.0	(ug/l)
Iron	mg/kg	43,400.0	6,690.0	(ug/l)
Lead	mg/kg	147.0	< 50.0	(ug/l)
Magnesium	mg/kg	2,750.0	1,570.0	(ug/l)
Manganese	mg/kg	471.0	458.0	(ug/l)
Mercury	mg/kg	11.3	< 0.2	(ug/l)
Nickel	mg/kg	26.0	151.0	(ug/l)
Metals (Continued)				
Selenium	mg/kg	< 3.1	3.4	(ug/l)
Silver	mg/kg	9.0	< 6.0	(ug/l)
Sodium	mg/kg	6,480.0	11,700.0	(ug/l)
Thallium	mg/kg	< 2.1	< 2.0	(ug/l)
Tin	mg/kg	34.0	< 30.0	(ug/l)
Titanium	mg/kg	390.0	< 5.0	(ug/l)
Zinc	mg/kg	1,480.0	2,040.0	(ug/l)
Semi-quantitative Metals				
Iodine	mg/kg	173,000.0	NA	
Iridium	mg/kg	10,300.0	NA	
Phosphorus	mg/kg	190,000.0	NA	
Silicon	mg/kg	50,100.0	NA	
Sulfur	mg/kg	91,200.0	NA	
Conventionals				

Not analyzed

Table IV-3 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility C

Pollutant Category and Pollutant	Units	Waste Activated Sludge Total Analysis S. P. 4 Day 3	Waste Activated Sludge TCLP Analysis S. P. 4 Day 3
Nonconventionals			
Ammonia, as N	mg/kg	< 34.0	NA
Corrosivity	mpy	< 10.0	NA
Flash Point	°C	> 65.0	NA
Nitrate + Nitrite, as N	mg/kg	21.0	NA
Nitrogen, Total Kjeldahl	mg/kg	1,800.0	NA
Residue, Total	Wt %	2.0	NA
Residue, Total Volatile	Wt %	85.0	NA
Sulfide, Total (Monier-Williams)	mg/kg	46.0	NA

<	Indicates compound was analyzed for but not detected. Reported with detection limit value.
>	Indicates saturated detector response. The concentration shown has been estimated from the data available and should be considered a minimum value.
mpc	Not detected. A response was noted but qualitative criteria were not met. The number reported is the maximum possible concentration calculated from the observed data.
ND	Indicates element was analyzed for but not detected.
NA	Indicates not analyzed.
NR	Indicates data not reported.
ug/l	microgram per liter
mg/l	milligram per liter
mg/kg	milligram per kilogram
ppt	part per trillion
ppq	part per quadrillion
mpy	millimeter per year

Table IV-4
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units	Primary Separator Influent S. P. 1 Day 2	Primary Separator Effluent S. P. 2 Day 1	Primary Separator Effluent S. P. 2 Day 2	Primary Separator Effluent S. P. 2 Day 3
Volatile Organics					
Acetone	ug/l	1,181	586	697	763
Acrylonitrile	ug/l	< 50	< 50	< 50	< 50
alpha-Picoline	ug/l	8,258	13,811	62,027	76,693
Benzene	ug/l	491	3,553	3,278	2,191
Bromoform	ug/l	< 10	< 10	< 10	115
Carbon disulfide	ug/l	12	43	54	25
Chloromethane	ug/l	9,216	< 50	< 50	< 50
Ethylbenzene	ug/l	204	1,043	1,000	1,105
Ethyl cyanide	ug/l	< 10	12,980	< 10	< 10
m-Xylene	ug/l	508	1,097	1,074	1,171
o+p-Xylene	ug/l	306	276	232	239
Styrene	ug/l	29,612	10,950	8,802	9,402
Toluene	ug/l	1,647	2,873	3,386	2,622
1,2:3,4-Diepoxybutane	ug/l	237	< 200	< 20	207
2-Butanone (MEK)	ug/l	204	215	215	99
4-Methyl-2-Pentanone	ug/l	196	< 50	< 50	< 50
Semivolatile Organics					
Acenaphthene	ug/l	2,193	3,241	47,273	28,255
Acenaphthylene	ug/l	8,458	2,663	2,395	1,629
Acetophenone	ug/l	287	< 100	< 10	516
alpha-Naphthylamine	ug/l	< 100	< 100	< 10	< 100
Aniline	ug/l	3,868	7,373	2,671	2,783
Anthracene	ug/l	20,055	5,110	7,149	4,937
Benzyl alcohol	ug/l	2,384	< 100	2,479	1,859
Biphenyl	ug/l	102,672	138,817	1,764,940	1,236,400
Carbazole	ug/l	1,156	< 200	6,632	4,469
Chrysene	ug/l	6,670	< 100	< 10	2,099
di-n-Butyl phthalate	ug/l	< 100	< 100	< 10	< 100
Dibenzofuran	ug/l	68,610	1,327	22,124	10,518
Dibenzothiophene	ug/l	15,971	4,838	6,309	4,341
Dimethyl phthalate	ug/l	< 100	373	< 10	< 100
Fluoranthene	ug/l	2,028	3,500	10,991	10,212
Fluorene	ug/l	63,617	1,524	29,182	20,106
n-Hexadecane	ug/l	2,086	902	654	384
Naphthalene	ug/l	30,803	32,839	585,860	499,404
o-Cresol	ug/l	1,807	26,147	3,810	3,323
o-Toluidine	ug/l	< 100	3,189	996	1,281
p-Cresol	ug/l	< 10	< 10	< 10	< 10

Table IV-4 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units	Primary Separator Influent S. P. 1 Day 2	Primary Separator Effluent S. P. 2 Day 1	Primary Separator Effluent S. P. 2 Day 2	Primary Separator Effluent S. P. 2 Day 3
Semivolatile Organics (continued)					
p-Cymene	ug/l	6,630	< 100	< 10	< 100
Perylene	ug/l	436	< 100	15	101
Phenanthrene	ug/l	1,511	2,768	31,399	16,061
Pyrene	ug/l	24,689	2,124	9,435	7,027
Thianaphthene	ug/l	2,226	2,572	3,394	2,345
Thioxanthone	ug/l	< 200	< 200	< 20	32,876
1-Methylfluorene	ug/l	131	< 100	54	< 100
1-Methylphenanthrene	ug/l	< 100	< 100	84	< 100
1-Phenylnaphthalene	ug/l	< 100	< 100	16	< 100
2-Methylnaphthalene	ug/l	< 100	6,430	< 10	< 100
2-Phenylnaphthalene	ug/l	319	< 100	46	< 100
2,3-Benzofluorene	ug/l	< 100	< 100	119	< 100
2,4-Dimethylphenol	ug/l	< 100	23,967	< 10	< 100
2,6-Dichlorophenol	ug/l	< 10	187	< 10	< 10
3,6-Dimethylphenanthrene	ug/l	< 100	< 100	23	< 100
4-Chloro-3-Methylphenol	ug/l	< 10	< 10	12	< 10
4,5-Methylenephenanthrene	ug/l	1,376	< 100	< 10	< 100
Dioxins/Furans					
Not analyzed					
Pesticides/Herbicides					
Not analyzed					
Metals					
Aluminum	ug/l	296.0	< 90.0	97.0	< 90.0
Antimony	ug/l	< 6.0	< 60.0	< 6.0	< 60.0
Arsenic	ug/l	18.6	10.7	11.1	5.2
Barium	ug/l	23.0	14.0	15.0	13.0
Boron	ug/l	119.0	< 10.0	164.0	< 10.0
Calcium	ug/l	17,200.0	15,300.0	17,000.0	15,600.0
Cobalt	ug/l	26.0	< 25.0	< 25.0	< 25.0
Copper	ug/l	60.0	19.0	15.0	12.0
Iron	ug/l	3,590.0	3,200.0	1,980.0	2,070.0
Lead	ug/l	< 50.0	< 50.0	< 50.0	< 50.0
Magnesium	ug/l	1,440.0	1,190.0	1,390.0	1,320.0
Manganese	ug/l	151.0	92.0	67.0	34.0
Mercury	ug/l	< 2.0	< 2.0	< 2.0	< 2.0
Silver	ug/l	< 6.0	< 6.0	< 6.0	< 6.0
Sodium	ug/l	71,900.0	10,100.0	15,900.0	7,680.0
Zinc	ug/l	203.0	78.0	60.0	133.0

Table IV-4 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units	Primary Separator Influent S. P. 1 Day 2	Primary Separator Effluent S. P. 2 Day 1	Primary Separator Effluent S. P. 2 Day 2	Primary Separator Effluent S. P. 2 Day 3
Semi-quantitative Metals					
Iodine	mg/l	ND	ND	ND	ND
Lithium	mg/l	ND	ND	ND	ND
Osmium	mg/l	ND	ND	ND	ND
Phosphorus	mg/l	1.1	ND	ND	ND
Potassium	mg/l	ND	ND	ND	ND
Silicon	mg/l	3.2	1.7	2.5	1.9
Strontium	mg/l	0.1	0.1	0.1	0.1
Sulfur	mg/l	20.6	4.8	6.0	1,410
Conventionals					
BOD	mg/l	640	1,100	700	710
Oil & Grease	mg/l	690	32	100	17
TSS	mg/l	20	8.4	9.2	10
Nonconventionals					
Ammonia, as N	mg/l	1.5	4.0	1.7	2.2
Chloride	mg/l	46	16	19	20
COD	mg/l	1,100	2,600	1,100	1,200
Flashpoint	°C	NR	NR	NR	> 65
Fluoride	mg/l	1.6	1.0	1.2	1.1
Nitrogen, Total Kjeldahl	mg/l	8.9	18	9.3	9.3
Nitrate + Nitrite, as N	mg/l	0.10	< 0.05	< 0.05	< 0.05
Phophorus, Total as P	mg/l	0.76	0.62	0.66	0.54
Specific Conductance	umho/cm-25 °C	440	280	180	150
Sulfate	mg/l	46	11	13	9.4
Sulfide, Total (Iodometric)	mg/l	11	7	3.4	2.7
TDS	mg/l	300	140	130	100
TOC	mg/l	240	670	340	330

Table IV-4 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units	Secondary Separator Effluent S. P. 3 Day 2	Final Effluent S. P. 4 Day 1	Final Effluent S. P. 4 Day 2	Final Effluent S. P. 4 Day 3	Final Effluent S. P. 4 Day 3 *Duplicate**
Volatile Organics						
Acetone	ug/l	1,013	< 50	< 50	801	< 50
Acrylonitrile	ug/l	< 50	< 50	< 50	< 50	< 50
alpha-Picoline	ug/l	59,395	28,785	28,393	37,387	37,748
Benzene	ug/l	1,890	519	446	773	688
Bromoform	ug/l	113	< 10	< 10	< 10	< 10
Carbon disulfide	ug/l	27	< 10	< 10	< 10	< 10
Chloromethane	ug/l	< 50	< 50	< 50	< 50	< 50
Ethylbenzene	ug/l	361	249	166	224	209
Ethyl cyanide	ug/l	< 10	< 10	< 10	< 10	< 10
m-Xylene	ug/l	335	274	191	295	207
o+p-Xylene	ug/l	169	127	100	138	113
Styrene	ug/l	5,305	3,226	2,043	2,919	4,066
Toluene	ug/l	1,515	550	432	655	568
1,2:3,4-Diepoxybutane	ug/l	< 200	< 200	< 200	< 200	< 200
2-Butanone (MEK)	ug/l	105	< 50	< 50	98	59
4-Methyl-2-Pentanone	ug/l	< 50	< 50	71	< 50	< 50
Semivolatile Organics						
Acenaphthene	ug/l	45,220	28,502	2,022	21,303	40,889
Acenaphthylene	ug/l	1,433	1,146	735	856	1,279
Acetophenone	ug/l	432	229	< 100	291	< 100
alpha-Naphthylamine	ug/l	< 100	< 100	131	< 100	< 100
Aniline	ug/l	2,491	1,606	1,263	1,734	2,809
Anthracene	ug/l	1,300	9,261	6,985	6,701	11,274
Benzyl alcohol	ug/l	2,728	2,278	2,291	2,251	2,204
Biphenyl	ug/l	125,947	670,424	60,492	381,072	985,669
Carbazole	ug/l	1,627	15,888	12,978	10,958	13,731
Chrysene	ug/l	5,874	5,690	3,257	< 100	6,635
di-n-Butyl phthalate	ug/l	< 100	2,369	< 100	< 100	< 100
Dibenzofuran	ug/l	24,931	19,748	12,049	15,289	24,909
Dibenzothiophene	ug/l	8,710	8,142	4,887	6,198	9,581
Dimethyl phthalate	ug/l	< 100	< 100	< 100	348	< 100
Fluoranthene	ug/l	55,678	25,758	3,161	27,564	44,897
Fluorene	ug/l	3,918	21,296	13,621	15,959	4,600
n-Hexadecane	ug/l	294	< 100	< 100	< 100	< 100
Naphthalene	ug/l	562,206	15,414	30,229	332,425	544,416
o-Cresol	ug/l	3,370	< 100	583	2,129	2,470
o-Toluidine	ug/l	869	443	1,027	628	753
p-Cresol	ug/l	49,425	< 10	< 10	< 10	< 10

Table IV-4 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units	Secondary Separator Effluent S. P. 3 Day 2	Final Effluent S. P. 4 Day 1	Final Effluent S. P. 4 Day 2	Final Effluent S. P. 4 Day 3	Final Effluent S. P. 4 Day 3 *Duplicate**
Semivolatile Organics (continued)						
p-Cymene	ug/l	< 100	< 100	< 100	< 100	< 100
Perylene	ug/l	244	175	232	171	279
Phenanthrene	ug/l	100,611	48,553	5,341	25,914	96,999
Pyrene	ug/l	3,484	18,571	1,973	1,647	2,647
Thianaphthene	ug/l	1,908	954	1,126	1,130	1,346
Thioxanthone	ug/l	< 200	< 200	48,007	45,652	< 200
1-Methylfluorene	ug/l	< 100	< 100	< 100	< 100	< 100
1-Methylphenanthrene	ug/l	< 100	< 100	< 100	< 100	249
1-Phenylnaphthalene	ug/l	< 100	< 100	< 100	< 100	< 100
2-Methylnaphthalene	ug/l	5,123	< 100	2,725	2,459	3,178
2-Phenylnaphthalene	ug/l	173	< 100	156	< 100	174
2,3-Benzofluorene	ug/l	< 100	< 100	< 100	< 100	< 100
2,4-Dimethylphenol	ug/l	< 100	< 100	< 100	< 100	< 100
2,6-Dichlorophenol	ug/l	< 10	138	< 10	< 10	< 10
3,6-Dimethylphenanthrene	ug/l	< 100	< 100	< 100	< 100	< 100
4-Chloro-3-Methylphenol	ug/l	< 10	< 10	< 10	< 10	< 10
4,5-Methylenephenanthrene	ug/l	< 100	488	632	< 100	1,402
Dioxins/Furans						
1,2,3,4,7,8-HxCDD	ppq	NA	NA	314	NA	NA
1,2,3,6,7,8-HxCDD	ppq	NA	NA	580	NA	NA
1,2,3,7,8,9-HxCDD	ppq	NA	NA	mpc 52	NA	NA
1,2,3,4,6,7,8-HpCDD	ppq	NA	NA	17,000	NA	NA
OCDD	ppq	NA	NA	101,000	NA	NA
1,2,3,4,7,8-HxCDF	ppq	NA	NA	mpc 62	NA	NA
1,2,3,4,6,7,8-HpCDF	ppq	NA	NA	914	NA	NA
OCDF	ppq	NA	NA	4,220	NA	NA
Total HxCDD	ppq	NA	NA	8,010	NA	NA
Total HpCDD	ppq	NA	NA	88,000	NA	NA
Total OCDD	ppq	NA	NA	101,000	NA	NA
Total HxCDF	ppq	NA	NA	< 216	NA	NA
Total HpCDF	ppq	NA	NA	4,470	NA	NA
Total OCDF	ppq	NA	NA	4,220	NA	NA
Pesticides/Herbicides						
alpha-BHC	ppt	NA	NA	2,680	NA	NA
Captan	ppt	NA	NA	3,200	NA	NA
Diallate	ppt	NA	NA	6,520	NA	NA
Endosulfan I	ppt	NA	NA	1,680	NA	NA
Heptachlor	ppt	NA	NA	3,520	NA	NA
Heptachlor Epoxide	ppt	NA	NA	1,200	NA	NA

Table IV-4 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units	Secondary Separator Effluent S. P. 3 Day 2	Final Effluent S. P. 4 Day 1	Final Effluent S. P. 4 Day 2	Final Effluent S. P. 4 Day 3	Final Effluent S. P. 4 Day 3 *Duplicate**
Metals						
Aluminum	ug/l	118.0	128.0	162.0	141.0	160.0
Antimony	ug/l	< 6.0	< 60.0	< 6.0	< 6.0	< 6.0
Arsenic	ug/l	10.3	28.5	14.9	13.8	14.3
Barium	ug/l	16.0	57.0	112.0	18.0	17.0
Boron	ug/l	108.0	31.0	62.0	46.0	36.0
Calcium	ug/l	17,000.0	59,700.0	106,000.0	16,900.0	16,700.0
Cobalt	ug/l	< 25.0	< 25.0	< 25.0	< 25.0	< 25.0
Copper	ug/l	9.0	12.0	11.0	13.0	13.0
Iron	ug/l	2,510.0	3,510.0	3,090.0	3,760.0	3,650.0
Lead	ug/l	< 50.0	< 50.0	< 50.0	< 50.0	< 50.0
Magnesium	ug/l	1,370.0	3,700.0	5,750.0	1,290.0	1,270.0
Manganese	ug/l	68.0	63.0	62.0	71.0	70.0
Mercury	ug/l	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Silver	ug/l	< 6.0	< 6.0	7.0	< 6.0	< 6.0
Sodium	ug/l	14,600.0	94,700.0	206,000.0	17,100.0	16,900.0
Zinc	ug/l	82.0	80.0	93.0	97.0	95.0
Semi-quantitative Metals						
Iodine	mg/l	ND	ND	ND	ND	ND
Lithium	mg/l	0.1	ND	ND	ND	ND
Osmium	mg/l	ND	ND	0.1	ND	ND
Phosphorus	mg/l	ND	1.0	1.1	1.0	ND
Potassium	mg/l	ND	ND	ND	ND	ND
Silicon	mg/l	2.8	2.3	2.5	2.1	2.3
Strontium	mg/l	0.1	0.2	0.4	0.1	0.1
Sulfur	mg/l	5.9	6.8	11.8	1,410	1,420
Conventionals						
BOD	mg/l	660	380	320	460	430
Oil & Grease	mg/l	160	21	97	12	22
TSS	mg/l	33	40	29	38	31

Table IV-4 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units	Secondary Separator Effluent S. P. 3 Day 2	Final Effluent S. P. 4 Day 1	Final Effluent S. P. 4 Day 2	Final Effluent S. P. 4 Day 3	Final Effluent S. P. 4 Day 3 *Duplicate**
Nonconventionals						
Ammonia, as N	mg/l	1.4	1.3	1.0	1.1	1.1
Chloride	mg/l	16	190	400	22	22
COD	mg/l	1,000	770	730	830	850
Flash Point	°C	NR	NR	NR	> 65.0	NR
Fluoride	mg/l	1.1	1.2	1.2	1.0	1.1
Nitrogen, Total Kjeldahl	mg/l	9.0	5.8	5.2	8.1	7.5
Nitrate + Nitrite, as N	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phophorus, Total as P	mg/l	0.67	0.79	0.50	0.69	0.75
Specific Conductance	umho/cm-25 °C	170	820	1,600	180	190
Sulfate	mg/l	12	18	26	10	13
Sulfide, Total (Iodometric)	mg/l	4.9	17	5.0	3.2	3.0
TDS	mg/l	110	500	1,000	140	140
TOC	mg/l	350	220	210	230	250

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* Duplicate of final effluent for quality control.

Table IV-4 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units		Retort Sludge Liquid S. P. 5 Day 2
Volatile Organics			
Acetone	ug/l		497
Acrylonitrile	ug/l		193
alpha-Picoline	ug/l	<	50,000,000
Benzene	ug/l		690
Bromoform	ug/l	<	10
Carbon disulfide	ug/l		25
Chloromethane	ug/l	<	50
Ethylbenzene	ug/l		333
Ethyl cyanide	ug/l	<	10
m-Xylene	ug/l		3,403
o+p-Xylene	ug/l		1,756
Styrene	ug/l	<	10,000,000
Toluene	ug/l		1,090
1,2:3,4-Diepoxybutane	ug/l	<	20,000,000
2-Butanone (MEK)	ug/l		106
4-Methyl-2-Pentanone	ug/l	<	50
Semivolatile Organics			
Acenaphthene	ug/l	<	10,000,000
Acenaphthylene	ug/l	<	10,000,000
Acetophenone	ug/l	<	10,000,000
alpha-Naphthylamine	ug/l	<	10,000,000
Aniline	ug/l	<	10,000,000
Anthracene	ug/l	<	10,000,000
Benzyl alcohol	ug/l	<	10,000,000
Biphenyl	ug/l	<	10,000,000
Carbazole	ug/l	<	20,000,000
Chrysene	ug/l	<	10,000,000
di-n-Butyl phthalate	ug/l	<	10,000,000
Dibenzofuran	ug/l	<	10,000,000
Dibenzothiophene	ug/l	<	10,000,000
Dimethyl phthalate	ug/l	<	10,000,000
Fluoranthene	ug/l	<	10,000,000
Fluorene	ug/l	<	10,000,000
n-Hexadecane	ug/l	<	10,000,000
Naphthalene	ug/l	<	10,000,000
o-Cresol	ug/l	<	10,000,000
o-Toluidine	ug/l	<	10,000,000
p-Cresol	ug/l	<	10,000,000

Table IV-4 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units		Retort Sludge Liquid S. P. 5 Day 2
Semivolatile Organics (continued)			
p-Cymene	ug/l	<	10,000,000
Perylene	ug/l	<	10,000,000
Phenanthrene	ug/l	<	10,000,000
Pyrene	ug/l	<	10,000,000
Thianaphthene	ug/l	<	10,000,000
Thioxanthone	ug/l	<	20,000,000
1-Methylfluorene	ug/l	<	10,000,000
1-Methylphenanthrene	ug/l	<	10,000,000
1-Phenylnaphthalene	ug/l	<	10,000,000
2-Methylnaphthalene	ug/l	<	10,000,000
2-Phenylnaphthalene	ug/l	<	10,000,000
2,3-Benzofluorene	ug/l	<	10,000,000
2,4-Dimethylphenol	ug/l	<	10,000,000
2,6-Dichlorophenol	ug/l	<	10,000,000
3,6-Dimethylphenanthrene	ug/l	<	10,000,000
4-Chloro-3-Methylphenol	ug/l	<	10,000,000
4,5-Methylenephenanthrene	ug/l	<	10,000,000
Dioxins/Furans			
Not analyzed			
Pesticides/Herbicides			
Not analyzed			
Metals			
Aluminum	ug/kg		14.0
Antimony	ug/kg		0.1
Arsenic	ug/kg		0.3
Barium	ug/kg		0.5
Boron	ug/kg		1.0
Cadmium	ug/kg		0.051
Calcium	ug/kg		159.0
Chromium	ug/kg		0.241
Copper	ug/kg		1.0
Iron	ug/kg		3.0
Lead	ug/kg		2.0
Magnesium	ug/kg		22.0
Manganese	ug/kg		3.0
Mercury	ug/kg		0.1
Sodium	ug/kg		2,960.0
Titanium	ug/kg		0.248
Zinc	ug/kg		13.0

Table IV-4 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility D

Pollutant Category and Pollutant	Units		Retort Sludge Liquid S. P. 5 Day 2
Semi-quantitative Metals			
Iodine	mg/kg		23.6
Lithium	mg/kg		10.5
Osmium	mg/kg		ND
Phosphorus	mg/kg		32.9
Potassium	mg/kg		7.2
Silicon	mg/kg		81.6
Strontium	mg/kg		0.6
Sulfur	mg/kg		429
Conventionals			
Not analyzed			
Nonconventionals			
Ammonia, as N	mg/kg		47
Flash Point	°C	>	65
Nitrate + Nitrite, as N	mg/kg		5.3
Nitrogen, Total Kjeldahl	mg/kg		130
Residue, Total	Wt %		26
Residue, Total Volatile	Wt %		99
Sulfide, Total (Monier-Williams)	mg/kg		37

>	Indicates saturated detector response. The concentration shown has been estimated from the available data and should be considered a minimum value.
<	Indicates compound was analyzed for but not detected. Reported with detection limit value.
ND	Indicates element was analyzed for but not detected.
NA	Indicates not analyzed.
NR	Indicates data not reported due to laboratory equipment problems.
mpc	Not detected. A response was noted but qualitative criteria were not met. The number reported is the maximum possible concentration calculated from the observed data.

ug/l	microgram per liter	ug/kg	microgram per kilogram
mg/l	milligram per liter	mg/kg	milligram per kilogram
ppt	part per trillion		
ppq	part per quadrillion		

Table IV-5
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Holding Tank Effluent S. P. 1 Day 1	Holding Tank Effluent S. P. 1 Day 2	Holding Tank Effluent S. P. 1 Day 3
Volatile Organics				
Acetone	ug/l	< 50	< 50	< 5000
Acrylonitrile	ug/l	< 50	< 50	< 5000
alpha-Terpineol	ug/l	< 100	< 100	< 100
Ethylbenzene	ug/l	< 10	< 10	< 1000
Methylene chloride	ug/l	< 10	< 10	< 1000
p-Dioxane	ug/l	< 10	< 10	< 1000
Toluene	ug/l	< 10	< 10	< 1000
2-Butanone (MEK)	ug/l	< 50	< 10	< 1000
2-Hexanone	ug/l	< 50	< 50	< 5000
Semivolatile Organics				
Acenaphthene	ug/l	< 100	182	< 100
Anthracene	ug/l	162	< 100	< 100
Benzo(a)anthracene	ug/l	< 100	< 100	< 100
Biphenyl	ug/l	< 100	613	< 100
bis(2-Ethylhexyl)phthalate	ug/l	< 100	< 100	< 100
Carbazole	ug/l	354	264	1,390
Chrysene	ug/l	< 100	< 100	798
Fluoranthene	ug/l	147	258	5,407
Fluorene	ug/l	578	626	< 100
Hexanoic acid	ug/l	43,013	59,299	8,150
Isobutyl alcohol	ug/l	< 10	< 10	< 1,000
n-Decane	ug/l	1,481	< 100	< 100
n-Docosane	ug/l	498	< 100	< 100
n-Dodecane	ug/l	2,273	< 100	< 100
n-Eicosane	ug/l	1,692	< 100	< 100
n-Hexacosane	ug/l	< 100	< 100	6,930
n-Hexadecane	ug/l	11,120	8,219	< 100
n-Octacosane	ug/l	< 100	< 100	174
n-Octadecane	ug/l	1,871	1,788	< 100
n-Tetracosane	ug/l	< 100	169	11,041
n-Tetradecane	ug/l	1,409	2,281	< 100
p-Cymene	ug/l	< 100	149	< 100
Pentachlorophenol	ug/l	< 50	< 500	38,373
Phenanthrene	ug/l	1,084	1,164	15,330
Phenol	ug/l	659	< 100	1,847
Pyrene	ug/l	133	194	4,913
2-Chlorophenol	ug/l	1,119	1,114	< 100
2,4-Dichlorophenol	ug/l	< 10	< 100	< 100
2,4,5-Trichlorophenol	ug/l	< 10	< 100	< 100

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Holding Tank Effluent S. P. 1 Day 1	Holding Tank Effluent S. P. 1 Day 2	Holding Tank Effluent S. P. 1 Day 3
Dioxins/Furans				
2,3,7,8-TCDD	ppq	< 9.1		
1,2,3,7,8-PeCDD	ppq	650	NA	NA
1,2,3,4,7,8-HxCDD	ppq	2,400	NA	NA
1,2,3,6,7,8-HxCDD	ppq	95,000	NA	NA
1,2,3,7,8,9-HxCDD	ppq	5,300	NA	NA
1,2,3,4,6,7,8-HpCDD	ppq	2,700,000	NA	NA
OCDD	ppq	15,000,000	NA	NA
2,3,7,8-TCDF	ppq	750	NA	NA
1,2,3,7,8-PeCDF	ppq	890	NA	NA
2,3,4,7,8-PeCDF	ppq	660	NA	NA
1,2,3,4,7,8-HxCDF	ppq	27,000	NA	NA
1,2,3,6,7,8-HxCDF	ppq	4,700	NA	NA
1,2,3,7,8,9-HxCDF	ppq	5,400	NA	NA
2,3,4,6,7,8-HxCDF	ppq	19,000	NA	NA
1,2,3,4,6,7,8-HpCDF	ppq	1,700,000	NA	NA
1,2,3,4,7,8,9-HpCDF	ppq	200,000	NA	NA
OCDF	ppq	10,000,000	NA	NA
Total TCDD	ppq	370	NA	NA
Total PeCDD	ppq	8,000	NA	NA
Total HxCDD	ppq	290,000	NA	NA
Total HpCDD	ppq	5,000,000	NA	NA
Total OCDD	ppq	15,000,000	NA	NA
Total TCDF	ppq	7,800	NA	NA
Total PeCDF	ppq	44,000	NA	NA
Total HxCDF	ppq	2,200,000	NA	NA
Total HpCDF	ppq	5,200,000	NA	NA
Total OCDF	ppq	10,000,000		
Pesticides/Herbicides				
Captan				
Dialate	ppt	2,200	NA	NA
Dichlone	ppt	12,000	NA	NA
Dicrotophos	ppt	3,800	NA	NA
Heptachlor epoxide	ppt	1,100	NA	NA
2,4-D	ppt	44,000	NA	NA
2,4,5-TP	ppt	< 50	NA	NA
4,4'-DDE	ppt	670	NA	NA

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Holding Tank Effluent S. P. 1 Day 1	Holding Tank Effluent S. P. 1 Day 2	Holding Tank Effluent S. P. 1 Day 3
Metals				
Aluminum	ug/l	8,800	10,000	28,200
Antimony	ug/l	< 40	< 40	< 40
Arsenic	ug/l	89.7	47.5	115.2
Barium	ug/l	700	200	510
Boron	ug/l	320	370	320
Cadmium	ug/l	< 40	< 40	40
Calcium	ug/l	212,000	210,000	204,000
Cobalt	ug/l	210	200	< 200
Copper	ug/l	< 60	< 60	240
Iron	ug/l	207,000	212,000	228,000
Magnesium	ug/l	37,900	39,100	39,500
Manganese	ug/l	11,400	11,800	12,100
Mercury	ug/l	82	36	< 10
Nickel	ug/l	320	330	340
Sodium	ug/l	192,000	187,000	171,000
Thallium	ug/l	80.4	254	121.8
Titanium	ug/l	30	40	70
Zinc	ug/l	1,410	1,470	3,240
Semi-quantitative Metals				
Iodine	mg/l	26	20	33
Phosphorus	mg/l	30	33	42
Potassium	mg/l	237	239	224
Silicon	mg/l	7.0	6.0	7.0
Strontium	mg/l	1.0	1.0	1.0
Sulfur	mg/l	52	46	41
Conventionals				
BOD	mg/l	5,000	5,600	7,300
Oil & Grease	mg/l	150	120	900
TSS	mg/l	480	390	3,400

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Holding Tank Effluent S. P. 1 Day 1	Holding Tank Effluent S. P. 1 Day 2	Holding Tank Effluent S. P. 1 Day 3
Nonconventionals				
Ammonia, as N	mg/l	27	23	20
Chloride	mg/l	370	380	330
COD	mg/l	16,000	16,000	34,000
Cyanide, Total	ug/l	< 20	24	< 20
Fluoride	mg/l	0.4	0.4	0.32
Nitrogen, Total Kjeldahl	mg/l	72	40	56
Nitrate + Nitrite, as N	mg/l	1.3	1.8	1.3
Phosphorus, Total as P	mg/l	26	2.6	35
Specific Conductance	umho/cm-25°C	2,800	NA	NA
Sulfate	mg/l	94	110	91
Sulfide, Total (Iodometric)	mg/l	< 1.0	< 1.0	< 1.0
TDS	mg/l	9,200	8,800	8,400
TOC	mg/l	5,200	5,400	5,300

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Spray Cooling Pond Effluent S. P. 2 Day 1	Spray Cooling Pond Effluent S. P. 2 Day 2	Spray Cooling Pond Effluent S. P. 2 Day 2 *Duplicate**	Spray Cooling Pond Effluent S. P. 2 Day 3
Volatile Organics					
Acetone	ug/l	< 50	< 50	< 50	< 5,000
Acrylonitrile	ug/l	< 50	< 50	< 50	< 5,000
alpha-Terpineol	ug/l	< 100	< 100	< 100	< 100
Ethylbenzene	ug/l	< 10	< 10	< 10	< 1,000
Methylene chloride	ug/l	< 10	< 10	< 10	< 1,000
p-Dioxane	ug/l	< 10	< 10	< 10	< 1,000
Toluene	ug/l	< 10	< 10	< 10	< 1,000
2-Butanone (MEK)	ug/l	< 50	< 50	< 50	< 5,000
2-Hexanone	ug/l	< 50	< 50	< 50	< 5,000
Semivolatile Organics					
Acenaphthene	ug/l	< 100	< 100	< 100	< 100
Anthracene	ug/l	< 100	< 100	< 100	< 100
Benzo(a)anthracene	ug/l	< 100	445	< 100	< 100
Biphenyl	ug/l	< 100	< 100	< 100	< 100
bis(2-Ethylhexyl)phthalate	ug/l	< 100	280	< 100	< 100
Carbazole	ug/l	< 200	2,710	< 200	< 200
Chrysene	ug/l	< 100	1,433	< 100	< 100
Fluoranthene	ug/l	4,044	6,489	4,725	3,991
Fluorene	ug/l	< 100	< 100	< 100	< 100
Hexanoic acid	ug/l	< 100	< 100	< 100	11,516
Isobutyl alcohol	ug/l	14	< 10	< 10	< 1,000
n-Decane	ug/l	< 100	< 100	< 100	< 100
n-Docosane	ug/l	164	< 100	11,263	4,763
n-Dodecane	ug/l	< 100	< 100	< 100	< 100
n-Eicosane	ug/l	< 100	< 100	< 100	< 100
n-Hexacosane	ug/l	< 100	8,300	< 100	< 100
n-Hexadecane	ug/l	< 100	< 100	< 100	< 100
n-Octacosane	ug/l	< 100	< 100	< 100	< 100
n-Octadecane	ug/l	< 100	< 100	< 100	< 100
n-Tetracosane	ug/l	1,834	10,763	1,827	2,767
n-Tetradecane	ug/l	< 100	< 100	< 100	< 100
p-Cymene	ug/l	< 100	< 100	< 100	< 100
Pentachlorophenol	ug/l	19,647	< 500	< 500	< 500
Phenanthrene	ug/l	4,100	25,740	< 100	< 100
Phenol	ug/l	< 100	< 100	< 100	< 100
Pyrene	ug/l	2,376	6,230	3,112	3,187
2-Chlorophenol	ug/l	< 100	< 100	< 100	< 100
2,4-Dichlorophenol	ug/l	< 100	< 100	< 100	< 100
2,4,5-Trichlorophenol	ug/l	< 100	< 100	< 100	< 100

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Spray Cooling Pond Effluent S. P. 2 Day 1	Spray Cooling Pond Effluent S. P. 2 Day 2	Spray Cooling Pond Effluent S. P. 2 Day 2 *Duplicate**	Spray Cooling Pond Effluent S. P. 2 Day 3
Dioxins/Furans					
Not analyzed					
Pesticides/Herbicides					
Not analyzed					
Metals					
Aluminum	ug/l	11,300	16,200	16,300	16,100
Antimony	ug/l	< 40	63.9	< 40	< 40
Arsenic	ug/l	33.1	51.1	70.2	76
Barium	ug/l	200	260	260	260
Boron	ug/l	< 100	330	210	200
Cadmium	ug/l	< 40	< 40	< 40	< 40
Calcium	ug/l	135,000	215,000	211,000	220,000
Cobalt	ug/l	< 200	< 200	< 200	210
Copper	ug/l	< 60	80	60	< 60
Iron	ug/l	107,000	155,000	155,000	170,000
Magnesium	ug/l	21,100	34,500	33,500	36,300
Manganese	ug/l	6,300	10,100	9,920	10,500
Mercury	ug/l	30	< 10	14	< 10
Nickel	ug/l	< 300	360	340	320
Sodium	ug/l	137,000	226,000	222,000	234,000
Thallium	ug/l	157	52.1	138.6	133.2
Titanium	ug/l	40	50	50	50
Zinc	ug/l	1,000	1,620	1,650	1,680
Semi-quantitative Metals					
Iodine	mg/l	11	22	20	24
Phosphorus	mg/l	22	31	34	31
Potassium	mg/l	134	213	208	213
Silicon	mg/l	3.0	6.0	5.0	5.0
Strontium	mg/l	ND	1.0	1.0	1.0
Sulfur	mg/l	29	38	44	48

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Spray Cooling Pond Effluent S. P. 2 Day 1	Spray Cooling Pond Effluent S. P. 2 Day 2	Spray Cooling Pond Effluent S. P. 2 Day 2 *Duplicate**	Spray Cooling Pond Effluent S. P. 2 Day 3
Conventionals					
BOD	mg/l	6,800	8,800	9,400	7,700
Oil & Grease	mg/l	410	1,000	1,100	100
TSS	mg/l	4,100	3,800	3,800	3,000
Nonconventionals					
Ammonia, as N	mg/l	28	24	19	30
Chloride	mg/l	480	330	320	340
COD	mg/l	50,000	37,000	33,000	34,000
Cyanide, Total	ug/l	< 20	20	< 20	< 20
Fluoride	mg/l	0.54	0.42	0.44	0.42
Nitrogen, Total Kjeldahl	mg/l	69	64	52	59
Nitrate + Nitrite, as N	mg/l	1.3	1.6	1.6	1.4
Phosphorus, Total as P	mg/l	32	2.9	2.7	29
Specific Conductance	umho/cm-25°C	2,600	NA	NA	NA
Sulfate	mg/l	56	66	71	68
Sulfide, Total (Iodometric)	mg/l	3.4	NR	NR	NR
TDS	mg/l	6,100	6,000	6,100	6,900
TOC	mg/l	5,000	4,800	4,600	4,700

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*Duplicate of spray cooling pond effluent for quality control.

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Bioreactor Influent S. P. 3 Day 1	Bioreactor Influent S. P. 3 Day 2	Bioreactor Influent S. P. 3 Day 3
Volatile Organics				
Acetone	ug/l	< 50	< 50	< 50
Acrylonitrile	ug/l	< 50	< 50	132
alpha-Terpineol	ug/l	< 100	< 100	< 100
Ethylbenzene	ug/l	< 10	< 10	62
Methylene chloride	ug/l	< 10	40	88
p-Dioxane	ug/l	< 10	< 10	123
Toluene	ug/l	< 10	26	205
2-Butanone (MEK)	ug/l	< 50	97	81
2-Hexanone	ug/l	< 50	< 50	53
Semivolatile Organics				
Acenaphthene	ug/l	< 100	< 100	< 100
Anthracene	ug/l	< 100	< 100	< 100
Benzo(a)anthracene	ug/l	< 100	< 100	< 100
Biphenyl	ug/l	< 100	< 100	< 100
bis(2-Ethylhexyl)phthalate	ug/l	< 100	< 100	< 100
Carbazole	ug/l	< 200	< 200	< 200
Chrysene	ug/l	< 100	< 100	< 100
Fluoranthene	ug/l	< 100	< 100	< 100
Fluorene	ug/l	< 100	< 100	< 100
Hexanoic acid	ug/l	< 10	19,285	46,181
Isobutyl alcohol	ug/l	< 10	< 10	< 10
n-Decane	ug/l	< 100	< 100	< 100
n-Docosane	ug/l	< 100	< 100	< 100
n-Dodecane	ug/l	< 100	< 100	< 100
n-Eicosane	ug/l	< 100	< 100	< 100
n-Hexacosane	ug/l	< 100	< 100	< 100
n-Hexadecane	ug/l	< 100	< 100	< 100
n-Octacosane	ug/l	< 100	< 100	< 100
n-Octadecane	ug/l	< 100	< 100	< 100
n-Tetracosane	ug/l	< 100	< 100	< 100
n-Tetradecane	ug/l	< 100	< 100	< 100
p-Cymene	ug/l	< 100	< 100	< 100
Pentachlorophenol	ug/l	12,478	8,487	9,249
Phenanthrene	ug/l	< 100	< 100	< 100
Phenol	ug/l	1,335	524	417
Pyrene	ug/l	< 100	< 100	< 100
2-Chlorophenol	ug/l	428	394	432
2,4-Dichlorophenol	ug/l	< 10	120	< 10
2,4,5-Trichlorophenol	ug/l	< 10	< 10	< 10

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Bioreactor Influent S. P. 3 Day 1	Bioreactor Influent S. P. 3 Day 2	Bioreactor Influent S. P. 3 Day 3
Dioxins/Furans				
2,3,7,8-TCDD	ppq	< 14	NA	NA
1,2,3,7,8-PeCDD	ppq	< 72	NA	NA
1,2,3,4,7,8-HxCDD	ppq	< 72	NA	NA
1,2,3,6,7,8-HxCDD	ppq	1,700	NA	NA
1,2,3,7,8,9-HxCDD	ppq	220	NA	NA
1,2,3,4,6,7,8-HpCDD	ppq	130,000	NA	NA
OCDD	ppq	1,100,000	NA	NA
2,3,7,8-TCDF	ppq	< 14	NA	NA
1,2,3,7,8-PeCDF	ppq	< 72	NA	NA
2,3,4,7,8-PeCDF	ppq	< 72	NA	NA
1,2,3,4,7,8-HxCDF	ppq	< 72	NA	NA
1,2,3,6,7,8-HxCDF	ppq	120	NA	NA
1,2,3,7,8,9-HxCDF	ppq	110	NA	NA
2,3,4,6,7,8-HxCDF	ppq	< 72	NA	NA
1,2,3,4,6,7,8-HpCDF	ppq	66,000	NA	NA
1,2,3,4,7,8,9-HpCDF	ppq	4,500	NA	NA
OCDF	ppq	540,000	NA	NA
Total TCDD	ppq	91	NA	NA
Total PeCDD	ppq	ND	NA	NA
Total HxCDD	ppq	5,200	NA	NA
Total HpCDD	ppq	210,000	NA	NA
Total OCDD	ppq	1,100,000		
Total TCDF	ppq	ND	NA	NA
Total PeCDF	ppq	140	NA	NA
Total HxCDF	ppq	34,000	NA	NA
Total HpCDF	ppq	370,000	NA	NA
Total OCDF	ppq	540,000		
Pesticides/Herbicides				
Captan	ppt	1,200	NA	NA
Diallate	ppt	< 1,000	NA	NA
Dichlone	ppt	3,700	NA	NA
Dicrotophos	ppt	< 2,880	NA	NA
Heptachlor epoxide	ppt	520	NA	NA
2,4-D	ppt	33,000	NA	NA
2,4,5-TP	ppt	14,000	NA	NA
4,4'-DDE	ppt	520	NA	NA

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Bioreactor Influent S. P. 3 Day 1	Bioreactor Influent S. P. 3 Day 2	Bioreactor Influent S. P. 3 Day 3
Metals				
Aluminum	ug/l	23,700	22,600	22,000
Antimony	ug/l	46	< 40	< 40
Arsenic	ug/l	< 20	44.8	40.9
Barium	ug/l	110	110	100
Boron	ug/l	210	250	< 100
Cadmium	ug/l	< 40	< 40	< 40
Calcium	ug/l	281,000	260,000	254,000
Cobalt	ug/l	280	280	250
Copper	ug/l	< 60	< 60	< 60
Iron	ug/l	71,800	55,100	53,200
Magnesium	ug/l	34,500	32,400	31,600
Manganese	ug/l	10,000	9,340	9,050
Mercury	ug/l	55	< 10	< 10
Nickel	ug/l	390	350	390
Sodium	ug/l	223,000	211,000	204,000
Thallium	ug/l	91.9	143.2	58.1
Titanium	ug/l	40	40	50
Zinc	ug/l	2,290	2,190	2,110
Semi-quantitative Metals				
Iodine	mg/l	ND	ND	ND
Phosphorus	mg/l	7.0	ND	ND
Potassium	mg/l	231	220	216
Silicon	mg/l	6.0	5.0	5.0
Strontium	mg/l	1.0	1.0	1.0
Sulfur	mg/l	64	68	60
Conventionals				
BOD	mg/l	3,200	5,300	5,500
Oil & Grease	mg/l	90	130	140
TSS	mg/l	49	26	24

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Bioreactor Influent S. P. 3 Day 1	Bioreactor Influent S. P. 3 Day 2	Bioreactor Influent S. P. 3 Day 3
Nonconventionals				
Ammonia, as N	mg/l	19	14	20
Chloride	mg/l	430	400	410
COD	mg/l	12,000	12,000	12,000
Cyanide, Total	ug/l	34	22	27
Fluoride	mg/l	0.4	0.38	0.36
Nitrogen, Total Kjeldahl	mg/l	43	14	24
Nitrate + Nitrite, as N	mg/l	< 0.05	< 0.05	< 0.05
Phosphorus, Total as P	mg/l	7.3	0.57	5.9
Specific Conductance	umho/cm-25°C	3,000	NA	NA
Sulfate	mg/l	160	160	150
Sulfide, Total (Iodometric)	mg/l	< 1.0	< 1.0	< 1.0
TDS	mg/l	7,000	6,700	6,700
TOC	mg/l	4,500	4,100	4,100

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Bioreactor Effluent S. P. 4 Day 1	Bioreactor Effluent S. P. 4 Day 2	Bioreactor Effluent S. P. 4 Day 2 *Duplicate**	Bioreactor Effluent S. P. 4 Day 3
Volatile Organics					
Acetone	ug/l	< 50	149	76	61
Acrylonitrile	ug/l	< 50	118	< 50	< 50
alpha-Terpineol	ug/l	< 100	< 100	17,038	< 100
Ethylbenzene	ug/l	< 10	< 10	< 10	47
Methylene chloride	ug/l	< 10	97	66	50
p-Dioxane	ug/l	< 10	< 10	< 10	< 10
Toluene	ug/l	< 10	< 10	< 10	< 10
2-Butanone (MEK)	ug/l	< 50	< 50	< 50	< 50
2-Hexanone	ug/l	< 50	< 50	< 50	< 50
Semivolatile Organics					
Acenaphthene	ug/l	< 100	< 100	< 100	< 100
Anthracene	ug/l	< 100	< 100	< 100	< 100
Benzo(a)anthracene	ug/l	< 100	< 100	< 100	< 100
Biphenyl	ug/l	< 100	< 100	< 100	< 100
bis(2-Ethylhexyl)phthalate	ug/l	< 100	< 100	< 100	< 100
Carbazole	ug/l	< 200	< 200	< 200	< 200
Chrysene	ug/l	< 100	< 100	< 100	< 100
Fluoranthene	ug/l	< 100	< 100	< 100	< 100
Fluorene	ug/l	< 100	< 100	< 100	< 100
Hexanoic acid	ug/l	< 10	96,643	96,607	< 10
Isobutyl alcohol	ug/l	< 10	< 10	< 10	< 10
n-Decane	ug/l	< 100	< 100	< 100	< 100
n-Docosane	ug/l	< 100	< 100	< 100	< 100
n-Dodecane	ug/l	< 100	< 100	< 100	< 100
n-Eicosane	ug/l	< 100	< 100	< 100	< 100
n-Hexacosane	ug/l	< 100	< 100	< 100	< 100
n-Hexadecane	ug/l	< 100	< 100	< 100	< 100
n-Octacosane	ug/l	< 100	< 100	< 100	< 100
n-Octadecane	ug/l	< 100	< 100	< 100	< 100
n-Tetracosane	ug/l	< 100	< 100	< 100	< 100
n-Tetradecane	ug/l	< 100	< 100	< 100	< 100
p-Cymene	ug/l	< 100	< 100	< 100	< 100
Pentachlorophenol	ug/l	< 50	< 50	< 50	< 50
Phenanthrene	ug/l	< 100	< 100	< 100	< 100
Phenol	ug/l	1,790	2,590	234	1,997
Pyrene	ug/l	< 100	< 100	< 100	< 100
2-Chlorophenol	ug/l	< 10	< 10	< 10	< 10
2,4-Dichlorophenol	ug/l	< 10	< 10	< 10	< 10
2,4,5-Trichlorophenol	ug/l	255	< 10	< 10	< 10

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Bioreactor Effluent S. P. 4 Day 1	Bioreactor Effluent S. P. 4 Day 2	Bioreactor Effluent S. P. 4 Day 2 *Duplicate**	Bioreactor Effluent S. P. 4 Day 3
Dioxins/Furans					
2,3,7,8-TCDD	ppq	< 14	NA	NA	NA
1,2,3,7,8-PeCDD	ppq	270	NA	NA	NA
1,2,3,4,7,8-HxCDD	ppq	1,900	NA	NA	NA
1,2,3,6,7,8-HxCDD	ppq	39,000	NA	NA	NA
1,2,3,7,8,9-HxCDD	ppq	24,000	NA	NA	NA
1,2,3,4,6,7,8-HpCDD	ppq	1,200,000	NA	NA	NA
OCDD	ppq	3,900,000	NA	NA	NA
2,3,7,8-TCDF	ppq	< 14	NA	NA	NA
1,2,3,7,8-PeCDF	ppq	< 72	NA	NA	NA
2,3,4,7,8-PeCDF	ppq	80	NA	NA	NA
1,2,3,4,7,8-HxCDF	ppq	< 72	NA	NA	NA
1,2,3,6,7,8-HxCDF	ppq	810	NA	NA	NA
1,2,3,7,8,9-HxCDF	ppq	< 72	NA	NA	NA
2,3,4,6,7,8-HxCDF	ppq	< 72	NA	NA	NA
1,2,3,4,6,7,8-HpCDF	ppq	55,000	NA	NA	NA
1,2,3,4,7,8,9-HpCDF	ppq	3,200	NA	NA	NA
OCDF	ppq	270,000	NA	NA	NA
Total TCDD	ppq	340	NA	NA	NA
Total PeCDD	ppq	5,700	NA	NA	NA
Total HxCDD	ppq	340,000	NA	NA	NA
Total HpCDD	ppq	2,300,000	NA	NA	NA
Total OCDD	ppq	3,900,000	NA	NA	NA
Total TCDF	ppq	1,400	NA	NA	NA
Total PeCDF	ppq	2,300	NA	NA	NA
Total HxCDF	ppq	50,000	NA	NA	NA
Total HpCDF	ppq	270,000	NA	NA	NA
Total OCDF	ppq	270,000	NA	NA	NA
Pesticides/Herbicides					
Captan	ppt	< 1,000	NA	NA	NA
Diallate	ppt	< 1,000	NA	NA	NA
Dichlone	ppt	1,500	NA	NA	NA
Dicrotophos	ppt	< 2,880	NA	NA	NA
Heptachlor epoxide	ppt	440	NA	NA	NA
2,4-D	ppt	4,400	NA	NA	NA
2,4,5-TP	ppt	5,400	NA	NA	NA
4,4'-DDE	ppt	< 500	NA	NA	NA

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Bioreactor Effluent S. P. 4 Day 1	Bioreactor Effluent S. P. 4 Day 2	Bioreactor Effluent S. P. 4 Day 2 *Duplicate**	Bioreactor Effluent S. P. 4 Day 3
Metals					
Aluminum	ug/l	25,100	26,300	17,900	20,500
Antimony	ug/l	< 40	44	< 40	47
Arsenic	ug/l	< 20	77.7	29	84.3
Barium	ug/l	240	360	180	280
Boron	ug/l	190	190	150	250
Cadmium	ug/l	< 40	< 40	< 40	< 40
Calcium	ug/l	268,000	269,000	244,000	260,000
Cobalt	ug/l	210	230	< 200	240
Copper	ug/l	< 60	< 60	< 60	70
Iron	ug/l	68,100	79,900	48,100	68,900
Magnesium	ug/l	32,300	33,000	31,100	31,000
Manganese	ug/l	9,790	8,940	7,170	8,410
Mercury	ug/l	16	< 10	< 10	< 10
Nickel	ug/l	370	390	< 300	390
Sodium	ug/l	1,010,000	736,000	709,000	778,000
Thallium	ug/l	124.4	< 20	< 20	183.3
Titanium	ug/l	50	60	50	< 30
Zinc	ug/l	2,070	2,420	1,310	2,120
Semi-quantitative Metals					
Iodine	mg/l	55	52	43	41
Phosphorus	mg/l	60	67	51	52
Potassium	mg/l	236	230	234	218
Silicon	mg/l	5.0	5.0	5.0	5.0
Strontium	mg/l	1.0	1.0	1.0	1.0
Sulfur	mg/l	35	42	29	24
Conventionals					
BOD	mg/l	3,600	3,600	3,300	2,100
Oil & Grease	mg/l	51	48	34	46
TSS	mg/l	1,800	2,500	1,500	1,400

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Bioreactor Effluent S. P. 4 Day 1	Bioreactor Effluent S. P. 4 Day 2	Bioreactor Effluent S. P. 4 Day 2 *Duplicate**	Bioreactor Effluent S. P. 4 Day 3
Nonconventionals					
Ammonia, as N	mg/l	150	67	67	68
Chloride	mg/l	400	430	480	370
COD	mg/l	10,000	8,200	7,900	7,600
Cyanide, Total	ug/l	< 20	28	< 20	< 20
Fluoride	mg/l	0.48	0.48	0.46	0.44
Nitrogen, Total Kjeldahl	mg/l	270	410	190	77
Nitrate + Nitrite, as N	mg/l	< 0.05	< 0.05	< 0.05	< 0.05
Phosphorus, Total as P	mg/l	110	12	4.1	28
Specific Conductance	umho/cm-25°C	6,000	NA	NA	NA
Sulfate	mg/l	< 4	14	2.2	< 2
Sulfide, Total (Iodometric)	mg/l	NR	NR	NR	NR
TDS	mg/l	6000	4400	4600	4600
TOC	mg/l	3100	2800	2900	2500

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*Duplicate of bioreactor effluent for quality control.

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Sludge Total Analysis S. P. 5 Day 3	Sludge TCLP Extract S. P. 5 Day 3	
Volatile Organics				
Ethyl benzene	ug/l	47	< 1,000	
Semivolatile Organics				
Benzo(a)anthracene	ug/l	500	< 10	
Carbazole	ug/l	1,935	< 20	
Chrysene	ug/l	931	< 10	
Fluoranthene	ug/l	7,891	53	
n-Hexacosane	ug/l	3,402	< 10	
n-Tetracosane	ug/l	9,522	< 10	
Pentachlorophenol	ug/l	13,436	< 50	
Pyrene	ug/l	5,454	33	
Dioxins/Furans				
Not Analyzed				
Pesticides/Herbicides				
Aldrin	ppt	4,800	< 100	
Dichlone	ppt	95,000	6,800	
Heptachlor	ppt	18,000	< 200	
2,4-D	ppt	49,000	< 50	
Metals				
Aluminum	mg/kg	6,920	4,230	ug/l
Arsenic	mg/kg	24.1	< 2.0	ug/l
Barium	mg/kg	107	279	ug/l
Boron	mg/kg	44.1	272	ug/l
Cadmium	mg/kg	3.8	< 4.0	ug/l
Calcium	mg/kg	8,790	39,400	ug/l
Chromium	mg/kg	15	29	ug/l
Cobalt	mg/kg	< 19	37	ug/l
Copper	mg/kg	48	11	ug/l
Iron	mg/kg	50,500	13,200	ug/l
Magnesium	mg/kg	1,220	5,320	ug/l
Manganese	mg/kg	343	1,800	ug/l
Mercury	mg/kg	2.7	< 10	ug/l
Nickel	mg/kg	< 28.8	68	ug/l

Table IV-5 (Continued)
Summary of Reported Analytical Results
Wood Preserving Facility E

Pollutant Category and Pollutant	Units	Sludge Total Analysis S. P. 5 Day 3	Sludge TCLP Extract S. P. 5 Day 3	
Metals (continued)				
Sodium	mg/kg	5,870	1,190,000	ug/l
Thallium	mg/kg	44.5	< 20	ug/l
Tin	mg/kg	< 28.8	31	ug/l
Titanium	mg/kg	20.1	< 3	ug/l
Zinc	mg/kg	139	511	ug/l
Semi-quantitative Metals				
Iodine	mg/kg	12,600	NA	
Phosphorus	mg/kg	13,100	NA	
Potassium	mg/kg	6,900	NA	
Silicon	mg/kg	671	NA	
Sulfur	mg/kg	31,900	NA	
Conventionals				
Not analyzed				
Nonconventionals				
Ammonia, as N	mg/kg	260	NA	
Cyanide	mg/kg	< 2	NA	
Nitrogen, Total Kjeldahl	mg/kg	1,800	NA	
Nitrate + Nitrite, as N	mg/kg	16	NA	
Residue, Total	Wt %	10	NA	
Residue, Total Volatile	Wt %	95	NA	
Sulfide, Total (Monier-Williams)	mg/kg	< 16	NA	

<	Indicates compound was analyzed for but not detected. Reported with detection limit value.
ND	Indicates element was analyzed for but not detected.
NA	Indicates not analyzed.
NR	Indicates data not reported.
ug/l	microgram per liter
mg/l	milligram per liter
mg/kg	milligram per kilogram
ppt	part per trillion
ppq	part per quadrillion

SECTION V
INDUSTRY POLLUTANT LOADS

This section presents estimated raw wastewater pollutant loads for the Boulton and Steam subcategories of the Timber Products Processing Point Source Category. All plants within the Waterborne or Nonpressure subcategory are subject to a "no discharge of process wastewater pollutants" regulation. Therefore, sampling episodes were not conducted at these facilities and pollutant loads were not calculated for the Waterborne or Nonpressure subcategory. For both the Boulton and Steam subcategories, estimated pollutant loads are presented for the following groups of pollutants:

- Priority and nonpriority volatile organics;
- Priority and nonpriority semivolatile organics;
- Dioxins and furans;
- Pesticides and herbicides;
- Metals;
- Semi-quantitative metals; and
- Conventional pollutants.

It is important to note that these estimated raw wastewater pollutant loads are based on a limited amount of data from this preliminary characterization study of the wood preserving industry. Raw wastewater pollutant loadings for wood preserving operations using organic preservatives are determined by calculating the loading after the initial oil/water separation stage (Reference 3, pp. 81 and 90). Raw wastewater pollutant concentrations for the Boulton subcategory were calculated using data from Facilities A, C, and D. Only treated effluent data were available from Facility B, the other Boulton subcategory facility, and these data were not included in the pollutant loading calculations. Similarly, wastewater generation rates for the Boulton subcategory were calculated using data from Facilities A, C, and D because no wastewater generation rate data were available from Facility B. For comparison purposes, raw wastewater pollutant loads were also calculated using wastewater generation rate data collected from 14 Boulton facilities in a 1981 study of the wood preserving industry (Reference 3).

Raw wastewater pollutant concentrations for the steam subcategory were calculated using data from Facility E, the only steam facility sampled for this preliminary characterization study of the wood preserving industry. No wastewater generation rate data were available from Facility E, and hence, raw wastewater pollutant loads for the Steam subcategory were calculated using wastewater generation rate data collected from eight steam facilities in the 1981 study (Reference 3). The pollutant concentration data used to calculate raw wastewater pollutant loads are presented in Table IV-1 and Tables IV-3 through IV-5 of this document.

Under the existing regulations at the time of the sampling episodes, very few Steam or Boulton subcategory facilities discharged wastewater to publicly-owned treatment works (POTWs), and even fewer discharged wastewater directly to receiving streams. Most facilities recycled or evaporated wastewater on site. Therefore, the raw wastewater pollutant loadings presented here represent the pollutant loadings generated by the industry at the time of the sampling but do not represent the loadings discharged by the industry, as very few facilities were actually discharging.

Outlined below is the methodology that was used to estimate the raw wastewater pollutant loads.

1. Average raw wastewater concentrations of individual compounds were calculated from the raw wastewater concentration data obtained during this preliminary characterization study of the wood preserving industry. The average concentrations of individual compounds were then summed to obtain a total concentration for each pollutant group. The estimates take into account only pollutants that were reported above detection limits in at

least one raw wastewater sample for each subcategory. Within each subcategory, three different methods were used to estimate average concentrations for each pollutant as described below.

- Method A - In this method, if a pollutant was not detected above the detection limit in an individual sample, the concentration of the pollutant in that sample was assumed to be zero in calculating an average concentration for the pollutant.
- Method B - In this method, if a pollutant was not detected above the detection limit in an individual sample, the concentration of the pollutant in that sample was assumed to be equal to the detection limit in calculating an average concentration for the pollutant.
- Method C - In this method, if a pollutant was not detected above the detection limit in an individual sample, that sample point was not included in calculating an average concentration for the pollutant.

Based on available data, Methods A and B provide an estimate of the range of mass loads for the industry. Method A assumes that if a specific concentration value was not reported for a pollutant, the pollutant was not present in the sample. Method B assumes that if a specific concentration value was not reported for a pollutant, the pollutant was present in the sample at a concentration just below the detection limit. Method C does not account for the fact that pollutants are not always present at reportable concentrations. Therefore, Method C overestimates pollutant loads and can be viewed as a "worst case" approach.

For the Boulton subcategory, the average pollutant concentrations were calculated based on two days of data from Facility A (Sample Point 1), three days of data from Facility C (Sample Point 1), and three days of data from Facility D (Sample Point 2). At Facilities A and D, the samples were collected at the influent to a secondary oil/water separator and, hence, had already undergone primary oil/water separation. At Facility C, the samples were collected at the influent to a biological treatment system and the wastewater sampled had undergone both primary and secondary oil/water separation. Only treated effluent data are available for Facility B, the other Boulton subcategory facility, and these data were not included in the calculation of raw wastewater pollutant loads.

For the Steam subcategory, the average pollutant concentrations were calculated based on three days of data from Facility E (Sample Point 1). The samples were collected at the influent to a spray cooling pond, after primary oil/water separation had occurred in the sumps in the retort area.

2. Wastewater generation rates for facilities in the Boulton and Steam subcategories were calculated using available data. For the Boulton subcategory, two separate methods were used to estimate the volume of wastewater discharged per mass of wood produced. The first method used the average of the production normalized wastewater generation rates for fourteen Boulton facilities measured during the 1981 study of the wood preserving industry (Reference 3). A flow rate of 1.26 gallons of wastewater generated per cubic feet of treated wood was estimated using this method. The second method used the average of the production normalized wastewater generation rates reported for Facilities A, C, and D. A flow rate of 0.96 gallons of wastewater generated per cubic foot of treated wood was estimated using this method. Wastewater generation rate data were not collected from Facility B for this preliminary characterization study of the wood preserving industry.

For the steam subcategory, wastewater volumes were estimated using the average of production normalized wastewater generation rate data collected from eight steam subcategory facilities during the 1981 study (Reference 3). The resulting estimate is 0.52 gallons of wastewater generated per cubic foot of treated wood. Wastewater generation rate data were not collected from Facility E for this preliminary characterization study.

3. The annual production of treated wood for each subcategory was calculated using available data. Available data included the amount of wood treated with each type of preservative (pentachlorophenol, creosote, inorganics) in 1987 and the percentage of facilities within each subcategory that treat with each preservative (References 1 and 3). The amount of wood treated within each subcategory was calculated by multiplying the percentage of facilities within each subcategory that use a specific preservative by the total amount of wood treated with that preservative. This methodology was chosen because data were not available indicating the number of facilities in each subcategory nor the production data for each facility in the industry. Based on these calculations, approximately 21.5 million cubic feet of wood are conditioned annually by the Boulton method and slightly over 129 million cubic feet of wood are conditioned by the steaming method.

4. Raw wastewater pollutant loadings were calculated by multiplying the average concentrations calculated in Step 1 by the production normalized wastewater generation rates calculated in Step 2 and then multiplying by the annual subcategory production calculated in Step 3.

Tables V-1 and V-2 show the estimated pollutant loads for the Boulton subcategory for each of the three methods used to estimate the average pollutant concentrations. The pollutant loads presented in Table V-1 are based on the average discharge flow rate from data collected at fourteen Boulton facilities during the 1981 study, and the pollutant loads presented in Table V-2 are based on the average discharge flow rate from data collected at Facilities A, C, and D during this preliminary characterization study. Table V-3 shows the estimated pollutant loads for the Steam subcategory for each of the three methods used to estimate the average pollutant concentrations. The pollutant loads presented in Table V-3 are based on the average discharge flow rate from data collected at eight steam facilities during the 1981 study.

The methodology outlined above was used to estimate raw wastewater pollutant loads. However, the numbers calculated are not estimates of the mass of pollutants discharged to surface waters by wood preserving facilities. First, the loads are based on raw wastewater concentrations prior to complete treatment. Most facilities employ treatment systems ranging from simple oil/water separation to multistage oil/water separation and biological treatment. Second, the loads are based on total wastewater generation rates prior to discharge flow reduction techniques such as evaporation, which are used by many facilities to reduce the amount of wastewater discharged.

Moreover, the majority of wood preserving facilities do not discharge directly to surface waters. Data collected from 131 facilities indicate that 70 percent of Boulton and Steam subcategory facilities have no wastewater discharge (Reference 3). Of the facilities that do discharge wastewater, the vast majority are indirect dischargers. Of the 14 facilities that were visited in 1988 and 1989 for this preliminary characterization study, 11 facilities did not discharge any process wastewater, three facilities were indirect dischargers, and none of the facilities discharged directly.

Existing effluent limitations guidelines require that Boulton subcategory facilities do not discharge wastewater. Although existing BPT limitations for wood preserving facilities in the Steam subcategory allow a direct discharge, no Steam subcategory facilities that directly discharge wastewater were identified during the preliminary characterization study.

It should also be noted that the estimated pollutant loads for the Steam subcategory are determined using data solely from facilities that employ the "closed steaming" process. Closed steaming, a widely used alternative to the open steaming process, minimizes contamination of steam condensate and typically results in a reduced volume of wastewater. Consequently, the raw wastewater loads reported for the Steam subcategory may underestimate the average raw wastewater pollutant loads from steam facilities if open steaming facilities are considered. Additional investigation of discharges from open steaming facilities would be required to quantify the discharge load difference between open and closed steaming facilities.

Once again, these estimated raw wastewater pollutant loads are based on a limited amount of data. Wastewater discharge flows and pollutant concentrations are dependent upon various factors such as preservative used, type of wood treated, facility specific procedures and practices and facility-specific control measures utilized. Wastewater flows and pollutant concentrations may vary widely from facility to facility within each subcategory.

Table V-1

Estimated Annual Raw Wastewater Pollutant Loads at 1.26 gal./cubic ft.
Boulton Subcategory Facilities
Preliminary Characterization Study of the Wood Preserving Industry

(Based on Subcategory Average Wastewater Generation Rate of 1.26 gal./cubic ft.)

Pollutant Group	**Method A (lbs/yr)**	**Method B (lbs/yr)**	**Method C (lbs/yr)**
Volatile Organics			
Priority Organics	870	900	1,200
Nonpriority Organics	7,100	7,200	16,000
Semivolatile Organics			
Priority Organics	41,000	41,000	46,000
Nonpriority Organics	94,000	95,000	130,000
Dioxins/Furans*	0.49	0.49	0.49
Pesticides/Herbicides	0.93	1.20	1.60
Metals**	3,700	3,700	4,400
Semi-quantitative Metals	45,000	ND	47,000
Conventional Pollutants			
BOD	190,000	190,000	190,000
Oil & Grease	12,000	12,000	12,000
TSS	5,700	5,700	5,700

*Note that 2,3,7,8-TCDD was detected in only two samples during this study, and the load presented here is a total mass and is not in terms of 2,3,7,8-TCDD equivalents.

**Calcium and Sodium were not included in the Metals calculations.

In Method A calculations, the concentration of individual pollutants was assumed to be zero if a specific value was not reported.

In Method B calculations, the concentration of individual pollutants was assumed to be equal to the detection limit if a specific value was not reported.

In Method C calculations, only pollutant concentrations above detection limits were considered.

ND - Not detected: no detection limit was reported.

Table V-2

Estimated Annual Raw Wastewater Pollutant Loads at 0.96 gal/cubic ft.
Boulton Subcategory Facilities
Preliminary Characterization Study of the Wood Preserving Industry

(Based on Subcategory Average Wastewater Generation Rate of 0.96 gal./cubic ft.)

Pollutant Group	Method A (lbs/yr)	Method B (lbs/yr)	Method C (lbs/yr)
Volatile Organics			
Priority Organics	660	690	940
Nonpriority Organics	5,400	5,500	12,000
Semivolatile Organics			
Priority Organics	31,000	31,000	35,000
Nonpriority Organics	72,000	72,000	100,000
Dioxins/Furans*	0.37	0.37	0.37
Pesticides/Herbicides	0.71	0.94	1.24
Metals**	2,800	2,800	3,400
Semi-quantitative Metals	35,000	ND	35,000
Conventional Pollutants			
BOD	150,000	150,000	150,000
Oil & Grease	8,900	8,900	8,900
TSS	4,400	4,400	4,400

*Note that 2,3,7,8-TCDD was detected in only two samples during this study, and the load presented here is a total mass and is not in terms of 2,3,7,8-TCDD equivalents.

**Calcium and Sodium were not included in the Metals calculations.

In Method A calculations, the concentration of individual pollutants was assumed to be zero if a specific value was not reported.

In Method B calculations, the concentration of individual pollutants was assumed to be equal to the detection limit if a specific value was not reported.

In Method C calculations, only pollutant concentrations above detection limits were considered.

ND - Not detected: no detection limit was reported.

Table V-3

Estimated Annual Raw Wastewater Pollutant Loads
Steam Subcategory Facilities
Preliminary Characterization Study of the Wood Preserving Industry

(Based on Subcategory Average Wastewater Generation Rate of 0.52 gal./cubic ft.)

Pollutant Group	Method A (lbs/yr)	Method B (lbs/yr)	Method C (lbs/yr)
Volatile Organics			
Priority Organics	ND	ND	ND
Nonpriority Organics	ND	ND	ND
Semivolatile Organics			
Priority Organics	13,800	14,000	29,000
Nonpriority Organics	31,000	31,000	39,000
Dioxins/Furans*	21	21	21
Pesticides/Herbicides	36	36	36
Metals**	160,000	160,000	160,000
Semi-quantitative Metals	190,000	--	190,000
Conventional Pollutants			
BOD	3,300,000	3,300,000	3,300,000
Oil & Grease	220,000	220,000	220,000
TSS	800,000	800,000	800,000

*Note that 2,3,7,8-TCDD was detected in only two samples during this study, and the load presented here is a total mass and is not in terms of 2,3,7,8-TCDD equivalents.

**Calcium and Sodium were not included in the Metals calculations.

In Method A calculations, the concentration of individual pollutants was assumed to be zero if a specific value was not reported.

In Method B calculations, the concentration of individual pollutants was assumed to be equal to the detection limit if a specific value was not reported.

In Method C calculations, only pollutant concentrations above detection limits were considered.

ND - Not detected: no detection limit was reported.

SECTION VI

CONTROL AND TREATMENT TECHNOLOGIES

A. INTRODUCTION

Based on the limited number of observations made during this preliminary characterization study, it appears that wastewaters from wood preserving processes contain a wide range of pollutants and that the types of pollutants found are, in general, consistent from one facility to another. A range of average raw waste concentrations detected for each pollutant group is provided in Table VI-1. These findings are based on data collected during this study at four Boulton subcategory facilities and one Steam subcategory facility, all of which use organic preservatives (pentachlorophenol and creosote). No sampling was performed at facilities that use inorganic preservatives because these facilities reuse all process wastewater and have no net wastewater discharge.

The following discussion of current practices and applicable control and treatment technologies is based on information previously presented in Section VII of the *Development Document for Effluent Limitations Guidelines for the Timber Products Point Source Category* (EPA 440/1-81/023, 1981) (Reference 3) and Section IV of the *Background Document Supporting the Proposed Listing of Wastes From Wood Preservation and Surface Protection Processes* (EPA, 1988) (Reference 2).

B. CURRENT PRACTICES

1. In-Plant Controls

In-plant controls are measures that a facility can use to reduce the quantity or strength of its wastewater and thus reduce or simplify treatment needs. Other in-plant measures are used to contain wastewater to avoid uncontrolled discharge. In-plant controls employed by wood preserving facilities include reducing the volume of wastewater generated and controlling drippage of preservative from treated wood.

Volume Reduction

Segregation of uncontaminated water from contaminated process water is one method employed to reduce wastewater volumes. One of the main sources of uncontaminated residual water at wood preserving plants is steam coil condensate. While in the past this water was frequently mixed with process wastewater, most facilities now segregate it, thus reducing the total volume of wastewater. Some facilities reuse steam coil condensate for boiler feed water, a practice that became feasible with the development of turbidity sensing equipment to monitor the water and sound a warning if oil enters the coil condensate return system. Reuse of steam coil condensate, while meaningful from a waste load reduction standpoint, can also represent a significant energy saving in terms of heat recovery.

The reuse of process water is becoming more common in the wood preserving industry. Facilities treating wood with inorganic preservatives are subject to a "no discharge of process wastewater pollutants" regulation, and all of these facilities reuse their process water. Also, several facilities that treat with organic preservatives reuse treated wastewater for boiler make-up or cooling water. Due to the nature of contamination present in wood preserving wastewater, some degree of treatment is required prior to reuse of wastewater for these purposes. According to a survey of the wood preserving industry conducted in 1987 by the American Wood Preservers Institute (AWPI), 56 percent of the facilities using only a creosote preservative reuse their process water. Of the facilities using either pentachlorophenol or a combination of pentachlorophenol and creosote, 40 percent reuse their process water (Reference 1).

Many wood preserving facilities are reducing the volume of wastewater generated by changing their wood treating practices and procedures. For example, in recent years facilities have moved away from open steaming to modified closed or closed steaming. In the modified closed steaming process, condensate from direct steaming is allowed to accumulate in the retort during the steaming operation until it covers the heating coils. At that point, direct steaming is stopped and the remaining steam is added to the system through the heating coils. This process change results in a reduced volume of contaminated condensate. In closed steaming, where no steam or condensate comes in direct contact with the wood or the preservative, condensate is returned to the boiler to be reused instead of being discarded.

The principal advantage of modified closed steaming or closed steaming over open steaming, aside from reducing the volume of wastewater released by a plant, is that wastewater effluents from the retort are less likely to contain emulsified oils. The direct steam impingement on the wood employed during open steaming can cause oil emulsions to form in the wastewater. In modified closed steaming or closed steaming, oils in the wastewater from the conditioning process generally remain as a separate layer, known as free oil. Free oils are more easily separated from the wastewater than emulsified oils; and, as a result of the reduction in oil content, the oxygen demand and the solids content of the wastewater are reduced significantly. A possible disadvantage of the use of modified or closed steaming is the fact that the rate of heat transfer of modified steaming is slower than direct steaming, and therefore, treating cycle times will be longer, resulting in a reduced production rate.

The technical feasibility of converting a wood preserving plant from open steaming to modified or closed steaming has been demonstrated by many plants within recent years. The decision to convert a plant to the closed steaming process is based on economic and product quality considerations related to the lower cost of end-of-pipe treatment of a smaller volume of wastewater generated by a converted plant, possible reduced production rate, and possible effects on product quality resulting from changes in the operational procedures.

Drippage Control

A major portion of the wastewater generated at wood preserving plants comes from spills and drippage in the process area. According to the industry survey conducted in 1987 by the AWPI, 91 percent of the facilities treating with inorganic preservatives have an impervious or a surface covered drip pad, and approximately 50 percent of the facilities treating with organic preservatives have an impervious or a surface covered drip pad (Reference 1). Drip pads are used to collect any preservative that drips from the treated wood when it is first removed from the treating cylinder. A larger percentage of the inorganic plants have surfaced drip pads because these facilities are usually newer than wood preserving facilities that treat with organic preservatives, and the facilities are specifically designed to collect and reuse any preservative drippage. Most of the facilities that have surfaced drip pads report collecting and reusing or treating any drippage.

Another location where preservative drippage may occur is the long-term storage yard for treated wood. Only 13 percent of the facilities treating with pentachlorophenol and/or creosote have surfaced storage pads for treated wood. Of the facilities treating with inorganic preservatives, 38 percent have some surfaced storage area (Reference 1).

2. End-of-Pipe Treatment

Wastewater treatment operations used by wood preserving facilities include oil/water separation, chemical flocculation, slow sand filtration, biological treatment, and evaporation.

Oil/Water Separation

Because of the deleterious effects that oil has on all subsequent steps in wastewater treatment, efficient oil/water separation is a prerequisite to effective wastewater treatment in the wood preserving industry. Oil, whether free or in an emulsified form, accounts for a significant part of the oxygen demand of wood preserving effluents. The oil also serves as a carrier for toxic pollutants such as polynuclear aromatics, pentachlorophenol, and other chlorinated phenolics that are present in wood preserving wastes at levels higher than the pollutant's solubility in water.

Oil/water separators of the API (American Petroleum Institute) type are extensively used by wood preserving plants for primary oil separation. API-type oil separators are preceded and followed at many plants by a rough oil separation and a second oil separation stage, respectively. Rough oil separation occurs either in the blowdown tank or in a surge tank preceding the API separator. Secondary separation usually occurs in another API separator operated in series with the first, or it may be conducted in any vessel or lagoon where the detention time is sufficient to permit further separation of free oil.

Chemical Flocculation

Because oil/water emulsions are not broken by mechanical oil removal procedures, chemical flocculation is required to reduce the oil content of wastewaters containing emulsions. Lime, ferric chloride, various polyelectrolytes, and clays of several types are used in the wood preserving industry for this purpose. Automatic metering pumps and mixing equipment have been installed at some plants to expedite the process of flocculation, which is usually carried out on a batch basis. COD reductions of 30 to 80 percent or higher are achieved by chemical flocculation, primarily as a result of oil removal. Average COD removal is about 50 percent.

Influent oil concentration to the flocculator varies with the efficiency of mechanical oil separation and the amount of emulsified oil present in the wastewater. The latter variable in turn is affected by type of preservative (either pentachlorophenol in a petroleum solution, pure creosote, or creosote in a coal tar or petroleum solution), conditioning method used, and design of oil-transfer equipment. Pentachlorophenol preservative solutions cause more emulsion problems than creosote or its solutions, and plants that steam condition -- especially those that employ open steaming -- have more emulsion problems than plants that use the Boulton conditioning method. Plants that use low pressure, high volume oil transfer pumps have less trouble with emulsions than those that use high pressure, low volume equipment.

At many plants, decantation is part of the flocculation system. Solids removal is expedited by use of vessels with cone-shaped bottoms. Frequently, the solids are allowed to accumulate from batch to batch, a practice which is reported to reduce the amount of flocculating agents required.

Slow Sand Filtration

Many plants which flocculate wastewater subsequently filter it through sand beds to remove the solids. When properly conducted, this procedure is highly efficient in removing both the solids resulting from the process as well as some of the residual oil. The solids which accumulate on the bed are removed periodically along with the upper inch or so of sand.

The application of incompletely flocculated wastewater to filter beds will severely impact the performance of the filter beds. The residual oil retards percolation of the water through the bed, thus necessitating the replacement of the oil saturated sand. This has happened frequently enough at some plants that the sand filters have been abandoned and a decantation process used instead.

Biological Treatment

Wastewater generated by the wood preserving industry is amenable to biological treatment. In fact, biological treatment can reduce concentrations of COD, total phenols, oil and grease, pentachlorophenol, and organic toxic pollutants in wood preserving wastewaters. The amount of reduction of these pollutants in the wastewater depends on influent wastewater quality, detention time in the biological system, amount of aeration provided, the acclimation of the biota, and the type of biological system employed. Trickling filters, aerated lagoons, oxidation ponds, and activated sludge systems are all used by one or more plants in the industry.

The biological treatment systems in place in the industry vary from aerated tanks with very short detention time and limited aeration capacity to sophisticated multi-stage systems comprised of activated sludge followed by aerated lagoons and oxidation ponds. Most plants which use biological treatment do so as a pretreatment step prior to discharge to a POTW or recycle of treated effluent.

Evaporation

Evaporation is a widely used technology for the minimization and elimination of the discharge of process wastewater pollutants to the surface waters of the United States. This technology has been selected by many wood preserving facilities in order to meet the requirements of federal and state regulations controlling the discharge of process wastewater pollutants.

Two types of evaporative technology are common in the wood preserving industry. One is evaporation of wastewater in a cooling tower, and the other is thermal evaporation. Cooling tower evaporation is used primarily by Boulton process facilities. In this system, the wood water vapor is drawn out of the treating cylinder and passes through the shell side of a surface condenser. The wood water vapor is condensed by cooling water passing through the tube side of the surface condenser. The condensed wood water is sent to an accumulator and from there to an oil/water separator for removal of oils. The separated water fraction from the oil/water separator is added to the cooling water, which recirculates through the tube side of the surface condenser picking up heat, then through a forced draft cooling tower where evaporation occurs. Rain water and cylinder drippings may also be routed to the oil/water separator and subsequently added to the cooling water.

Because the vacuum cycle in a Boulton facility lasts from 12 to 40 hours, sufficient waste heat is usually available to evaporate all of the wastewater generated at a facility without the addition of heat from an external source or the discharge of wastewater. Heat from an external source, usually process steam, may be added to assist the evaporation of peak volumes of wastewater generated from time to time.

In the steam conditioning process, total cycle time is much shorter, usually less than 10 hours; the vacuum phase of the cycle is usually one to three hours. Therefore, there is not a continuous (or nearly continuous) source of waste heat available to evaporate wastewater. Generally, the availability of heat for the evaporation of process wastewater from steaming operations is not sufficient to eliminate the discharge of process wastewater.

The second method of evaporation is thermal evaporation using an external heat source. As this method is particularly energy intensive and expensive, it is not always a feasible method. Some facilities perform preliminary operations such as sawing or debarking their wood before they preserve it. These processes generate waste wood which may be burned and used as a heat source for evaporation.

In the past, some wood preserving facilities have reported storing or disposing of process wastewater in land-based units such as surface impoundments (Reference 2). However, application of wastewater to land may cause media transfer problems such as groundwater contamination.

C. APPLICABLE CONTROL AND TREATMENT TECHNOLOGIES

This section discusses several control and treatment technologies which may be applicable to treat wood preserving wastewaters including membrane systems, adsorption, and chemical oxidants. These technologies have not yet been demonstrated in the wood preserving industry. A model treatment system for a wood preserving facility would probably require a combination of these treatment steps based on site-specific factors to achieve complete control.

Membrane Systems

Membrane filtration is a term applied to a number of different processes or technologies capable of achieving different degrees of separation. For the removal of organic materials such as pentachlorophenol and creosote constituents, reverse osmosis (RO) or ultrafiltration (UF) can be used. The basic difference between the two processes is that the RO membrane is capable of rejecting inorganic salts while the UF membrane allows them to pass through. Salt rejection occurs because of the repulsion of the charged inorganic ions from the surface of the membrane and the adsorption of the pure water to the membrane. RO membranes are usually classified by their ability to reject sodium chloride (NaCl). In general, the higher the NaCl rejection, the smaller the pores in the membrane.

For uncharged organic molecules, the mechanism of removal is a molecular sieving action with the rejection obtained related to the size and shape of the molecule.

Various organic compounds will either be rejected or pass through, depending on the pore size of the membrane.

In order for membrane systems to be effective, the influent wastewater to the membrane system must be relatively "clean" (low in suspended solids). Because of this requirement, membrane systems have had limited application in the past.

Adsorption and Synthetic Adsorbents

Polymeric adsorbents have been recommended for use under conditions similar to those in which carbon adsorption is employed. Advantages of these materials include efficient removal of both polar and nonpolar molecules from wastewater, and the ability to tailor an adsorbent for a particular contaminant. Clay minerals, such as altapulgite clay, have also been recommended for use in removing certain organics and heavy metals from wastewater. This technology also requires a fairly "clean" influent to be efficient and cost effective.

Chemical Oxidation

The use of chlorine and hypochlorite as a treatment to oxidize phenol-based chemicals in wastewater has been investigated in the past. The continued use of chlorine as an oxidizing agent for phenols is in question for various reasons. There is a concern over recent supply problems and the increasing cost of the chemical. Additionally, there is potential for the formation of chlorinated organics including trihalomethanes and chlorinated dioxins and furans. For these reasons, attention is now being given to other oxidizing agents. Some of the other agents being researched are hydrogen peroxide, ozone, and potassium permanganate.

Table VI-1

Range of Average Raw Waste Concentrations
Preliminary Characterization Study of the Wood Preserving Industry

Pollutant	Concentration Range
Volatile Organics	1 - 60 mg/l
Semivolatile Organics	10 - 400 mg/l
Dioxins/Furans*	1 - 40 ug/l
Pesticides/Herbicides	2 - 70 ug/l
Metals**	7 - 300 mg/l
Conventionals	
BOD	300 - 8,000 mg/l
Oil and Grease	10 - 900 mg/l
TSS	10 - 4,000 mg/l
Nonconventionals	
COD	800 - 40,000 mg/l
TOC	100 - 6,000 mg/l

*Note that 2,3,7,8-TCDD was only detected in two samples of this study, and the concentration presented here is a total concentration and is not in terms of 2,3,7,8-TCDD equivalents. OCDD and OCDF were the predominant species found.

**Calcium and Sodium were not included in the Metals analysis.

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